PRICE 35 CENTS

FEBRUARY 1955

Welding Engineer

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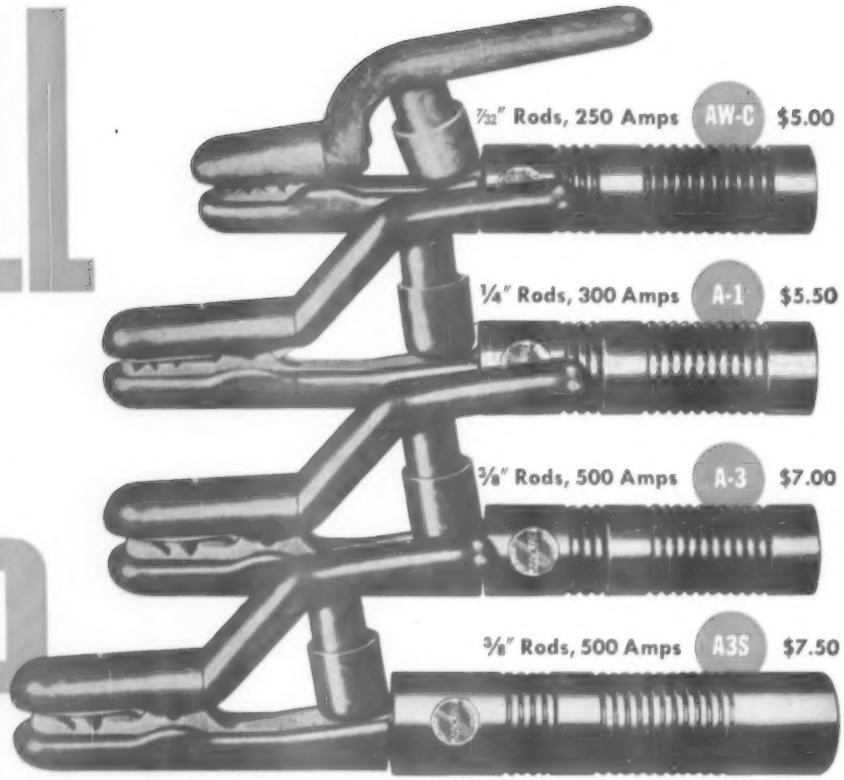
How to arc weld the stainless steels 40

STILL ON TOP



Jackson holders have long been in the lead, not only in the number of electrode holders sold, but on the basis of *quality*. Those shown here are made of a superior, 98% copper alloy, heat treated for greater strength, hardness and conductivity.

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	Tensile Strength lbs. per sq. inch	Elongation	Hardness Rockwell 'B'	Electrical Conductivity
JACKSON	70,000	2%	70	35%
Make "B"	25-30,000	10-20%	6-7	25-30%
Make "C"	25-30,000	10-20%	10	16%

The Jacksons won on all points: *higher tensile strength*, to take almost any abuse; *lower elongation*, to hold their shape; *greater hardness*, to take the wear and tear between the jaws; *more conductivity* to take the current with a minimum loss.

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Your Jackson Dealer will be glad to show you these and many other Jackson Electrode Holders. Also ask for the improved Ground Clamps and the latest in Jackson Welding Helmets and Safety Hats.

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For even longer economical performance, Jackson offers holders similar to models A-1, A-3, and A-3S, shown above, with the added feature of replaceable lower jaws.

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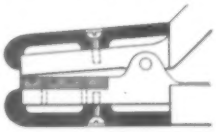
Model AA-3.....$ 8.00
Model AA-3S.....$ 8.50



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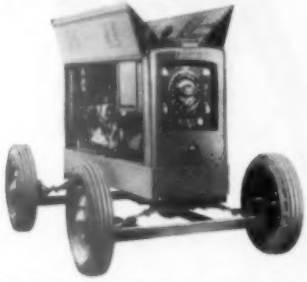

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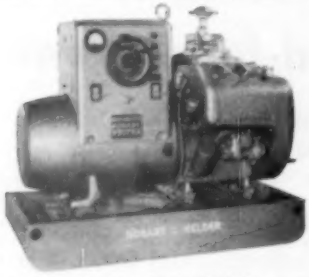

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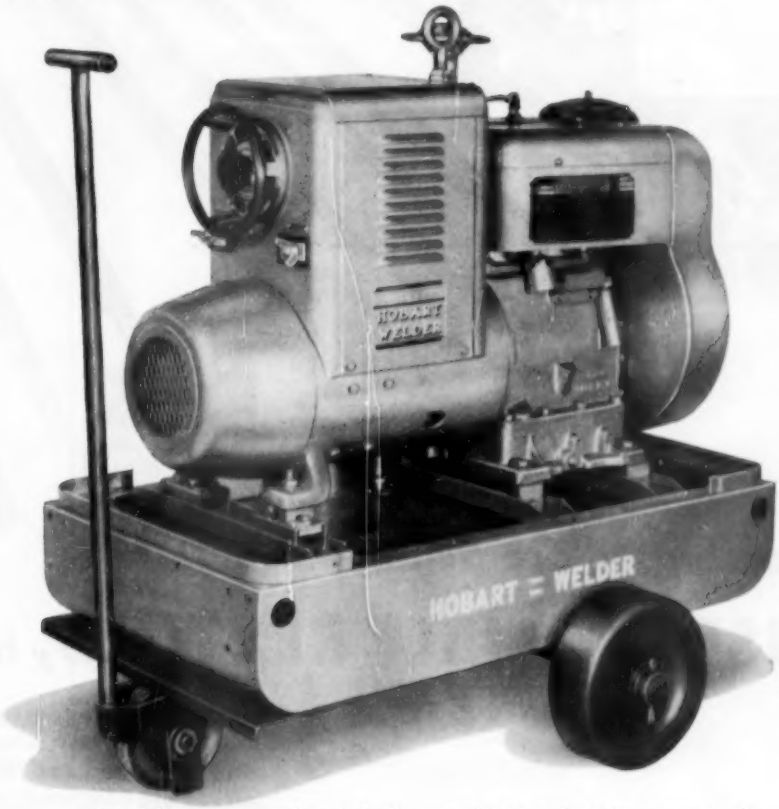

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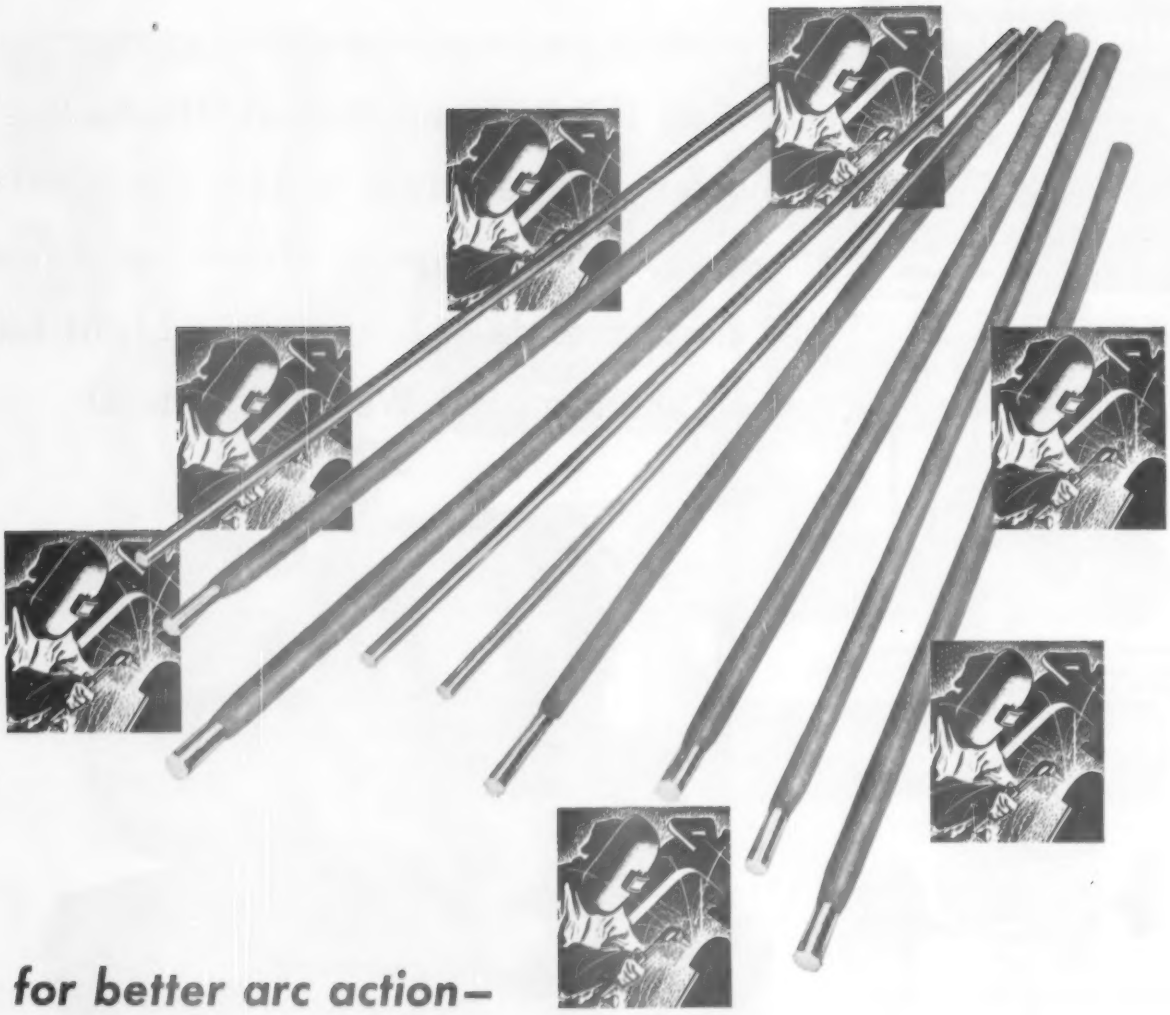

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Welding Engineer

February, 1955
Vol. 40—No. 2

A MAGAZINE OF JOINING AND SEVERING OF METALS

America's pioneer publication which, combined with The Acetylene Journal, has been devoted to the interest of the welding and allied industries since 1898

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Cover: *Ornamental palm tree is 16-gage steel sheet rolled and welded. Leaves and monkey are aluminum, but the coconuts are the real thing. They are found outside the home of Weldor John Patricia at Sussex, N. J. See page 26.*

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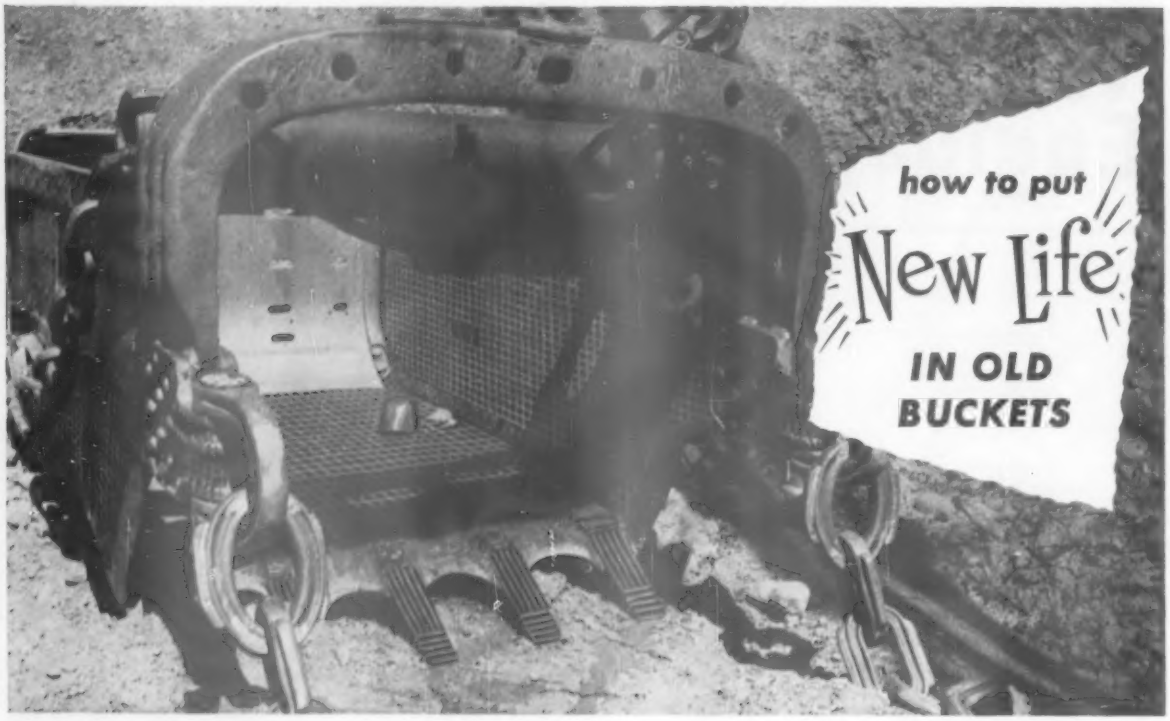

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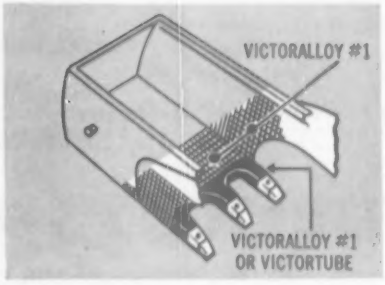

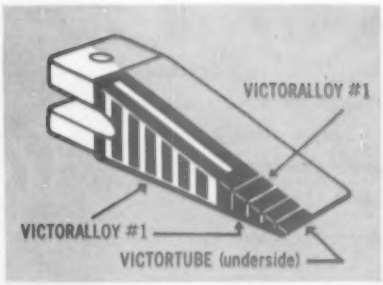

Buckets . . . Apply VICTORALLOY #1 to top and bottom of bucket lips in overlapping beads. Protect other parts or areas showing wear with stringer beads of VICTORALLOY #1. Use 3/16" coated VICTORALLOY #1 at 170 to 190 amperes, a.c. or d.c., or ¼" at 200 to 225 amperes. If wear is unusually severe, substitute VICTORITE on bucket lips; use 3/16" coated at 120 to 150 amperes, a.c. or reverse-polarity d.c.

Teeth . . . Apply VICTORTUBE to underside from point upward about 2", and VICTORALLOY #1 to upper side of tooth same distance. Use stringer beads of VICTORALLOY #1 on balance of upper and lower surfaces, and on edges. Use 3/16" coated VICTORTUBE at 130 to 160 amperes, a.c. or reverse-polarity d.c., and 3/16" coated VICTORALLOY at 170 to 190 amperes, a.c. or d.c.

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19-H

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PRESIDENT G. H. Roberts (center) of Detroit Stamping Co. explains product to Ernst O. A. Berendt (right), German editor, and Vernon Greene, FOA project manager

ALL division offices of Union Carbide in the Cleveland area are now located in this new modern building

NEWS

German editors visit Detroit Stamping Co.

Ten German trade-magazine editors were recent guests of Detroit Stamping Co., as a part of a nationwide tour under the sponsorship of the federal government's Foreign Operations Administration.

Detroit Stamping, manufacturer of welding clamps, was the only plant to be visited in the Detroit area. It was chosen as one of several U. S. firms whose manufacturing facilities provide a good source of information for articles to be written in German trade magazines covering American manufacturing and merchandising methods.

* * *

New council to coordinate technical activities of AWS

Formation of a technical council to plan, review and coordinate all its varied technical activities has been announced by the American Welding Society. Establishment of this council is intended to further increase the society's services to its members and to the welding and allied industries.

The new council is composed of authorities in the welding industry. Chairman is I. Morrison of Morrison Steel Products, Inc. Members are: R. W. Clark, General Electric Co.; G. O. Hoglund, Aluminum Co. of America; J. H. Humberstone, Air Reduction Sales Co., Inc., society president; F. L. Plummer, Hammond Iron Works, junior past president; J. G. Magrath, secretary of the society, ex-officio; and S. A. Greenberg, technical secretary of the society, who will serve as secretary for the council.

* * *

Fibre-Metal to mark golden anniversary

Fibre-Metal Products Co., Chester, Pa., producer of welding accessories and industrial safety equipment, will mark its 50th year of such manufacture in 1955.

* * *

Anti-Borax purchases Cortland Compound Co.

Anti-Borax Compound Co. Inc., Fort Wayne, Ind., has purchased all assets of Cortland Welding Compound Co., Cortland, N.Y. All trademarks, formulas, etc., were included in the sale. Familiar forge-welding compounds, such as "Cherry Heat," "Climax" and "Boraxette," as well as the "Weld-A-Cast" fluxes, will be manufactured in the Anti-Borax plant.

* * *

Westinghouse plans new jet research center

Plans to build new jet engine research and development facilities costing more than $12,500,000 have been announced by Westinghouse Electric Corp. The new facilities—which include both high and low-power laboratories and an experimental engineering shop—will be located at the present site of the huge jet-engine plant south of Kansas City, Mo.

Union Carbide moves Cleveland offices

After a number of years with offices in five different buildings, Union Carbide and Carbon Corp., New York City, has consolidated its Cleveland offices in a new modern office building and distributing center at 1300 Lakeside Ave.

The building is located on a plot of land large enough for possible future expansion. Part of it is a one-story office and stockroom, the other part is a two-story office building. It is of steel frame construction with brick masonry walls. Special features include air-conditioning, fluorescent lighting, ample parking facilities and a lunchroom.

The new headquarters houses all the divisions of Union Carbide now located in the Cleveland area. These include Bakelite Co., Carbide and Carbon Chemicals Co., Electro Metallurgical Co., Haynes Stellite Co., Linde Air Products Co. and National Carbon Co.

* * *

Lukens licensed to make new alloy steel "T-1"

A license to manufacture "T-1" constructional alloy steel has been granted Lukens Steel Co., Coatesville, Pa., by United States Steel Corp.

This new alloy was developed by U. S. Steel. It is said to have high yield strength, yet be tough enough to stand unusual stresses and pressures at both high and low temperatures and be easily welded. Its yield strength of 90,000 psi is three times that of ordinary carbon steel.

Some of the principal uses for "T-1" are plates for pressure vessels, mining and earth moving equipment, industrial applications where heat, impact and abrasion are unusually destructive, tension members of bridges, and wind tunnels.

NEWS

from page 5

BARGE'S steel "A" frame was prefabricated on sub-assembly platen. Weldment replaced rotted wood frame

WISCONSIN distributor has indoor dock, modern stock-room and convenient wire rope and belting set-up

Welded "A" frame installed on barge

In what is said to represent the first job of its type ever performed in the Bay area, Bethlehem Pacific's San Francisco shipyard recently designed, fabricated, and installed on Leslie Salt Co.'s dredge *Mallard* a new all-welded steel "A" frame to replace the original wooden frame which had become unserviceable because of dry rot.

The new steel frame, which weighed less than the old wooden one, was 40-ft high and fabricated of 12-in., 8-in. and 4-in. standard pipe. It featured a unique masthead weldment to withstand the high loads at that point. The original masthead swivel, hoist sheaves, boom and pilot house were re-used and incorporated in the new design.

After removal of the original frame, the steel frame was transferred from the sub-assembly area and installed on the dredge in one piece and secured with special fastenings into the hull trusses. Prefabricating permitted the yard to cut in half the time required to make the alterations. The dredge was out of service only 12 working days.

* * *

Welding show June 8-10 in Kansas City, Mo.

The American Welding Society's third annual welding show, to be held at Municipal Auditorium, Kansas City, Mo., June 8 to 10, will be the first national heavy-industry exposition ever to be staged in that city.

The society will conduct its annual spring technical meeting concurrently with the show but starting a day earlier.

Exhibit space taken by manufacturers already exceeds the total used at the society's show in Buffalo last May and more than 95% of the available space in the Kansas City Auditorium was contracted for prior to the first public announcement of the show.

* * *

New firm in Oregon will make welding fittings

Zidell Machinery & Supply Co., Portland, Ore., and the Clyde Tube Forgings Ltd., Glasgow, Scotland, have announced formation of a new $1,000,000 company for the manufacture in Portland of welding fittings for ships, refineries, chemical plants and commercial construction. Zidell has been United States distributor for Glasgow-manufactured fittings for the past three years.

The manufacturing firm will be known as Clyde Tube Forgings of America and will occupy a new 65 by 400-ft steel building to be erected adjoining the Zidell waterfront property in Portland. Plans call for operation by next May. Initially, fittings of carbon steel will be produced; those of copper, stainless steel, chrome and other alloys will be added later.

* * *

Kaiser opens three new sales offices

Kaiser Aluminum & Chemical Sales, Inc., Oakland, Calif., has opened three new branch sales offices. One is in the Denver Club Building, 518 Seventeenth St., Denver. This office formerly was located at 910 Sixteenth St. Another is in Gateway Center, 140 Stanwix St., Pittsburgh. The Pittsburgh office formerly was located at Grant St. and Fourth Ave. The third is at 1806 Madison Ave., Toledo.

Larger quarters for Madison distributor

Pictured above is the building that houses the Red Arrow Sales Corp., Madison, Wis., welding supply distributor. Established in 1940, the firm is distributor for Linde Air Products Co., Harnischfeger Corp. and The Lincoln Electric Co. The new building at 650 E. Main St., consists of 12,000 sq ft of floor space and contains an indoor loading dock that can accommodate five trucks.

President of the firm is R. J. Koltes; secretary-treasurer is Karl Wagner.

* * *

NWSA Western Zone meeting this month

The National Welding Supply Association will hold its Western Zone meeting in the Fairmont Hotel, San Francisco, on Feb. 10 and 11.

* * *

Midwest welding conference agenda includes titanium

The metallurgy of welding, brazing, and soldering titanium will be pointed up Feb. 8 and 9 at the first annual Midwest welding conference at Armour Research Foundation of Illinois Institute of Technology, Chicago.

Carl E. Hartbower, chief of welding section at Watertown Arsenal, Watertown, Mass., will discuss the subject at the two-day conference sponsored by ARF and the Chicago section of the American Welding Society.

Among other welding researchers and users of welding processes to speak at the conference are:

E. C. Osborne, quality control

(Continued on page 76)

when life hangs in the balance only the very finest equipment can meet the challenge...

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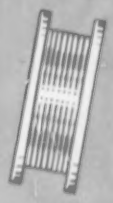

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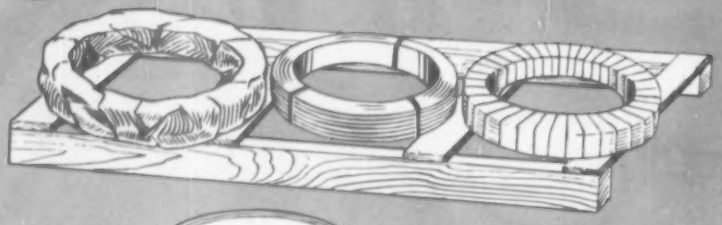
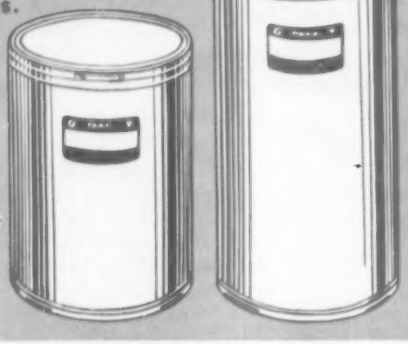


PALLETS: 1000-lb., 2000-lb., 3000-lb. Wire is wrapped in waterproofed paper



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"We think it's superior to all other 6013 electrodes in running characteristics."

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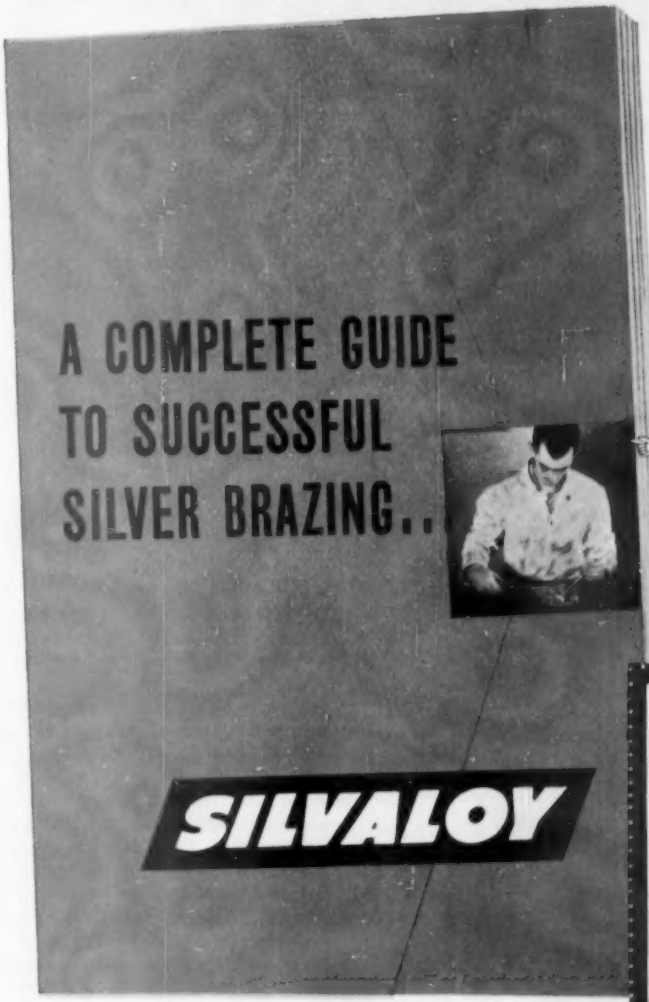
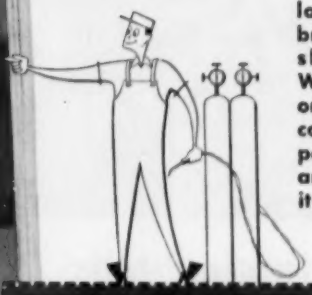


We knew a thorough, careful and complete job had been done when our 56-page pocket-size "COMPLETE GUIDE TO SUCCESSFUL SILVER BRAZING" was completed and offered to those interested in the subject.

It is therefore rewarding to have received requests for more than 128,000 copies from production men, engineers, maintenance units of the Armed Services, welding schools, libraries, etc. We are proud and pleased to have such overwhelming evidence that the booklet is a practical, informative, highly useful reference work.



If you are interested in low-temperature silver brazing, certainly, you should have a copy. We'll be happy to send one to you. Fill-in the coupon — paste it on a postcard or enclose it in an envelope and return it to us.

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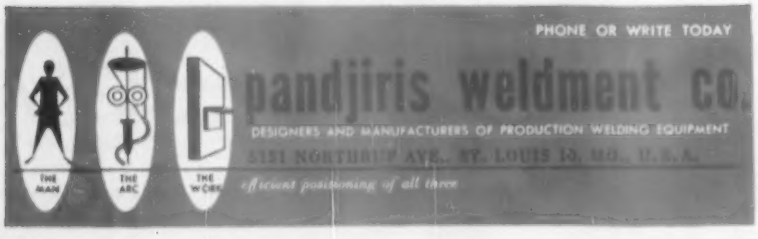
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Letters should be addressed to: The Editor, WELDING ENGINEER, 12 E. Grand Ave., Chicago 11, Ill. No letter will be published unless signed, but your name will be withheld if you request it.

More recognition?

Dear Sir:

Now that all the controversy over the name "weldor" is settled, I think the time has come for everyone in the field of welding to put forth some effort to have his trade recognized. Welding has contributed so much to the comfort of every phase of our datily lives, either directly or indirectly, that the man who welds should be respected on an equal footing with craftsmen in other trades.

Weldors have been called boilermakers, iron workers, sheet metal workers, steamfitters, etc., too long. We have a name now, and it is time it carried some respect. The Department of Labor should take the initiative and declare welding a trade. I'm sure the trade unions and industry wouldn't find this too hard to adjust to. To call welding "a tool of trades" may have sounded fine in 1918, but today it is a craft requiring as much skill, knowledge and experience as any other.

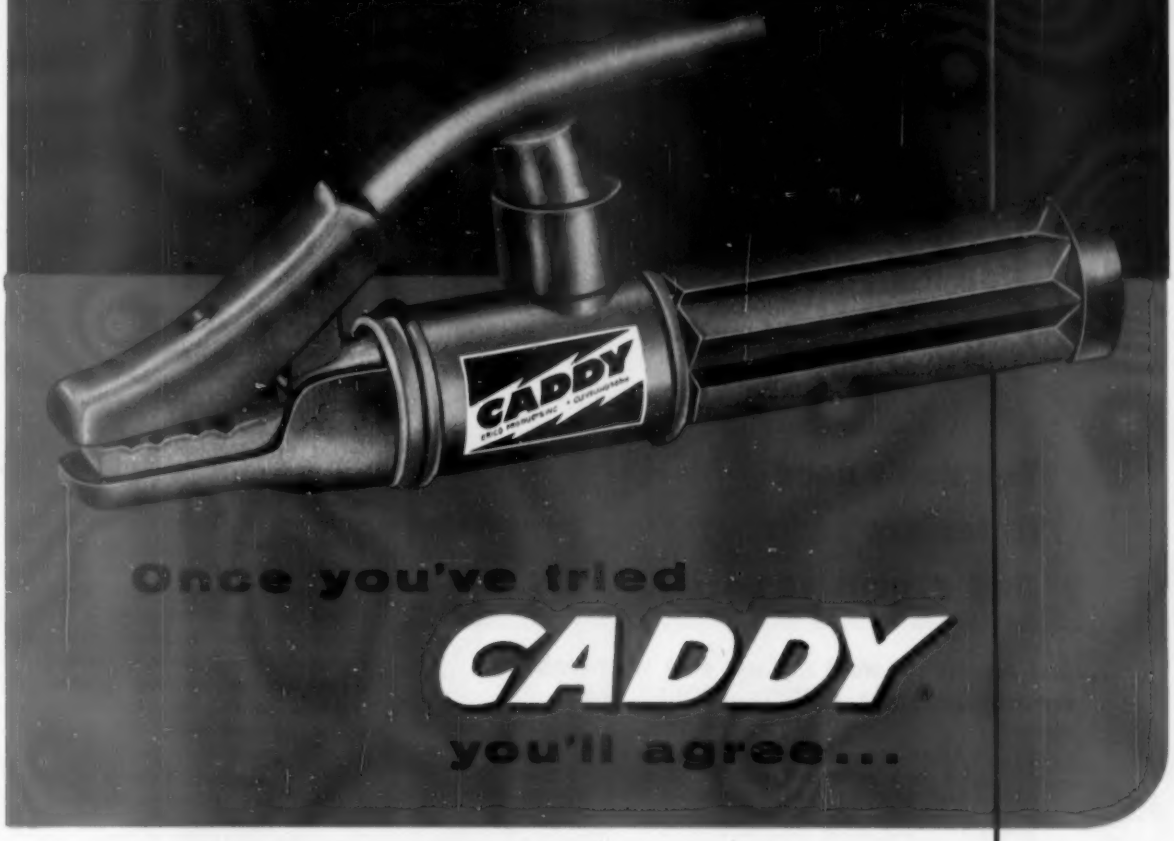
A few years ago, I was called upon to represent a group of weldors at a National Labor Relations Board hearing. This was held in order to determine whether maintenance mechanics were entitled to a separate bargaining agent, apart from factory employees. All trades were represented, and each man had to prove his right to be called a craftsman. We all won our case. But most important of all . . . weldors were classified as craftsmen in their own right. The two most outstanding points in favor of the weldors were:

(1) Weldors are required to prove their skill and ability by taking periodic tests.

(2) Welding is a trade which must be learned by instruction and practice.

The do-it-yourself mechanic of average mechanical ability can do minor jobs in almost any trade. But if he found a leak in his coffee pot,

LET'S PUT IT ON THE LINE —



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From five distinct grades of Ampco-Trode, you get exactly the deposit hardness you require — 130 to 380 BHN. You tailor your overlay to the job.

Available in a wide range of diameters as electrodes for metal-arc, or covered 36" filler rods for carbon-arc processes. Also bare 36" filler rod for TIG, and coiled wire for MIG and submerged-arc welding.

Don't scrap those worn parts — make them better than-new with Ampco-Trode. Call your local Ampco distributor or mail the coupon today. *Reg. U. S. Pat. Off.

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----ATTACH THIS COUPON TO A POSTCARD AND MAIL TODAY!----

AMPCO METAL, INC., Dept. WE-2, Milwaukee 46, Wisconsin

I'd like to know more about increasing part life with Ampco-Trode. Send me full information.

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W-130

he couldn't begin to repair it by welding—not unless he had previous experience or instruction.

Welding alone may not be difficult to learn, but when a man becomes skilled through experience, I believe he should be recognized as a craftsman.

I have not seen the definition given to the word "weldor" in the dictionary. This definition should definitely have these words included: "A man with skill, knowledge and ability in the craft of welding."

Yours truly,
Joseph S. Kovacs
Rahway, N. J.

* * *

A problem

Dear Sir:

We have the problem of automatically adjusting a flash welding machine to a variety of workpieces. This might break down simply into the problem of handling subsequently in a flash welder four pieces of work, each with a different cross-section. Each of these would require different current, flashing time, push up, etc.

Please advise us if you have published any information on any machines or controls which would accomplish the automatic adjustment of a flash welding machine (or of a spot welder) to the requirements of a variety of workpieces.

Very truly yours,
Joseph S. Francis
Senior Design Engineer
Acme Steel Co.
Chicago

Tear sheets have been forwarded to Mr. Francis, as well as the name of a firm specializing in solving such problems.

"Didn't the new shield come in yet? My little boy wants his space helmet!"

Do you have an INERT GAS welding problem?

Here are some tips that can save you money!

There's a right Sylvania Tungsten Electrode for every inert gas welding job . . . and a right technique for using the preferred electrode. The following welding helps are the result of field surveys and investigations by the research engineering staff of Rensselaer Polytechnic Institute, and Sylvania Electric Products, Inc.

A. C. WELDING

Metals Welded: Aluminum and magnesium are the metals most frequently welded with alternating current.

Tungsten Electrode: For the usual range of welding applications, Sylvania Zirtung electrodes will give the most dependable and the best performance. Under certain special conditions, Sylvania Thoriated Tungsten and Puretung Electrodes can be used acceptably.

If you have trouble with these problems . . . use these tips . . .

Difficult Starting	Clean work material thoroughly Use superimposed high frequency
Brittle Electrode Tips	Use larger size electrode
Excessive Heat in Electrode or Holder	Use larger size electrode Use centerless ground finish in larger size electrode
Freezing to Workpiece	Try longer arc Use a larger size electrode
Poor Penetration	Use higher current Try helium or a mixture of helium-argon

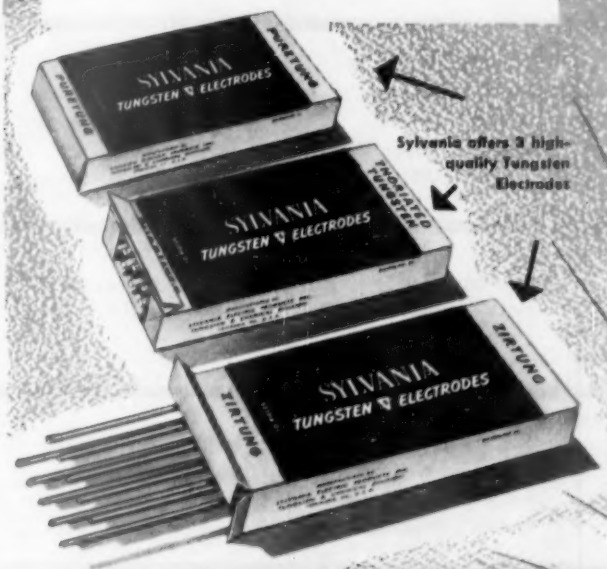
D. C. WELDING

Metals Welded: Stainless steel, inconel, monel and other similar metals.

Tungsten Electrode: For the usual range of welding applications, Sylvania THORIATED TUNGSTEN electrodes will give the most dependable and best performance. Under certain specialized conditions, Sylvania Zirtung and Puretung Electrodes can be used acceptably.

If you have trouble with these problems . . . use these tips . . .

Difficult Starting or Low Voltages	Point the electrode Try touch starting Use argon instead of helium Start fillets with filler rod (if permissible)
Brittle Electrode Tips	Point the electrode Use a larger size electrode
Excessive Heat in Electrode or Holder	Point the electrode Use a larger size electrode Use centerless ground finish in larger size electrode
Metal Pickup, Contamination of Electrode Tip, Erratic Arcs	Use a larger size electrode Use argon instead of helium
Poor Penetration	Use higher current Try Sylvania Zirtung Try helium or helium-argon mixes
Imprecise Welding (especially on fillets or tight corners)	Point the electrode Use starting block
Eroded Electrode	Use a larger size electrode Point the electrode Use a longer arc



Sylvania offers 3 high-quality Tungsten Electrodes

SYLVANIA ELECTRIC PRODUCTS, INC. • 1740 BROADWAY, NEW YORK 19, N. Y.
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Your guide to LOW-COST WELD GRINDING

Reducing heavy weld with CARBOFLEX Depressed Center Wheels

	CARBOFLEX Depressed Center Wheels	MX® Depressed Center Wheels	MX® Discs
RECOMMENDED USES	Heavy weld Removal, Portable Cutting-off, Slotting	Light and Medium Weld and Flash Removal, Rough Blending Flat Surfaces	Light Weld and Flash Removal, Blending and Semi-finishing Flat surfaces
RATE OF CUT	Fast on undercutting welds, cutting off and slotting	Fast on welds and flash—medium on flat surfaces	Medium fast on light welds and flat surfaces
OTHER ADVANTAGES	Rigid—strongly reinforced for maximum safety	Slightly flexible—yet strong, safe. Excellent for work on soft metals and alloys	Flexible, yet rigid enough for cleaning channels, interior seams, corner welds

...continually putting more sense in your abrasive dollar

Grinding and finishing weld bead with PORT-A-BELT Grinding Attachment

Smoothing seam of welded aluminum casting with MX Disc

RESIN SANDER Discs

Light and heavy Weld Removal, Blending and Finishing contours and flats

Fast stock removal on all surfaces

Flexible—depending on sander pad used. Low cost—long life

Economical weld grinding begins when you choose the right abrasive product to do the job... from the complete line by CARBORUNDUM. Four of the most widely used types are charted here. There are many others... such as cup wheels, straight wheels, rubber-bushed wheels, PORT-A-BELT Grinding Attachments, etc. Each has its place—each does one or more weld grinding jobs faster, more economically than any other tool.

YOUR CARBORUNDUM Salesman or Distributor offers expert counsel, prompt delivery of the right abrasive product at the right time. Call him.

THE CARBORUNDUM COMPANY, Dept. WE 81-57, Niagara Falls, N. Y.

Please send: ☐ Folder on CARBOFLEX Depressed Center Wheels
☐ Booklet on MX Abrasive Products
☐ Folder on PORT-A-BELT Grinding Attachments
☐ Information on_____

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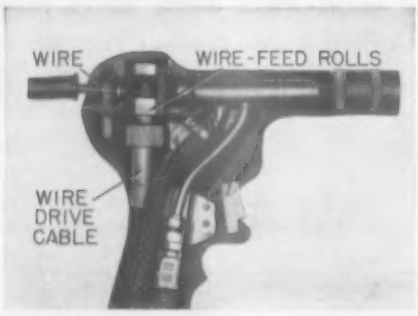
WELDING ARCS NEWS

WHY G-E FILLERARC EQUIPMENT GIVES YOU MORE APPLICATIONS FOR YOUR INVESTMENT



WIDE RANGE OF WIRE SIZES—.020 to .093—are accommodated by the Fillerarc gun. Gun accepts even smallest diameter wires because it feeds wire by *pulling*—prevents kinking.

HIGH WIRE-FEED SPEEDS—up to 1000 in./mt.—are realized with Fillerarc wire drive—making possible a wide range of applications.

G-E high-speed Fillerarc process solves mild-steel problem at Lukenweld; holds correct arc length automatically, to eliminate burn-back and stubbing

Fillerarc is General Electric's equipment for consumable-electrode, gas-shielded welding. It is semi-automatic and includes a self-regulating generator, a hand gun, and a wire-drive unit which delivers wire-feed speeds up to 1000 inches per minute. Fillerarc equipment has been successfully used on aluminum, aluminum bronze, stainless steel, copper, magnesium, titanium, nickel—and recently—mild steel.

LUKENWELD DIVISION of Lukens Steel, Coatesville, Pa., recently began using Fillerarc equipment to weld mild-steel compressor cases. According to John L. Lang, Welding Engineer for Lukenweld, Fillerarc equipment was chosen over the submerged melt process for two main reasons: easy control of the arc and the absence of flux. (Flux can be damaging to compressor components.) Welds were of sound quality, without undercutting. Compressor cases passed 150-lb pressure tests and snifter tests.

REDUCED BURN-BACK and stubbing are natural benefits of the Fillerarc generator . . . proved at Lukenweld:

Lukenweld—to meet special production requirements—fixed the Fillerarc hand gun in a mount over a revolving positioner. This positioner held the compressor case. Now, since the gun was fixed, arc length had to remain constant. Otherwise, sudden shortening of the arc could cause stubbing—or a sudden lengthening could cause burn-back to the gun. In either case, time would be lost and the weld damaged.

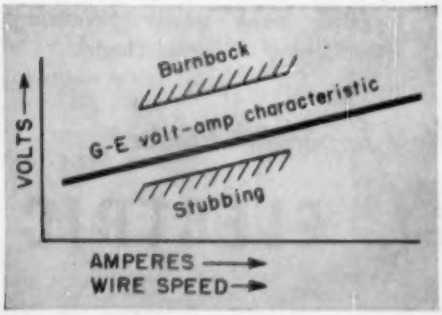
The Fillerarc generator automatically held the desired arc length—regardless of adjustments in wire-feed speed. Burn-back and stubbing were avoided.

THIS IS PROOF that an operator handling the gun *manually* doesn't have to manipulate it to compensate for arc length or go back to the generator to readjust arc length. He merely sets the voltage and wire-feed speed, and aims the gun. The Fillerarc generator does the rest.

For details on the versatility of G-E Fillerarc equipment, see the story below. General Electric Co., Schenectady, N. Y.

FOR FREE BULLETIN—SEND COUPON ON NEXT PAGE

G-E SELF-REGULATING GENERATOR is the only power source specially designed for this process. Insures proper current for any wire speed.

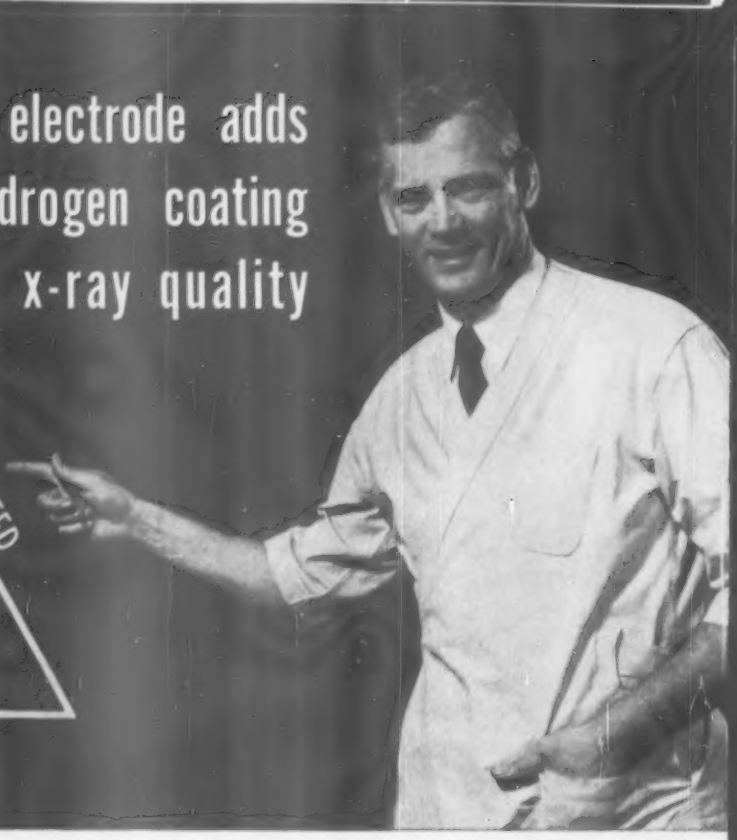


RISING VOLT-AMP CURVE of the exclusive G-E Fillerarc generator matches arc curves . . . does not get into burn-back and stubbing areas. Resulting high weld quality is uniform.

REMOTE CONTROL of wire-feed speed permits the operator to control burn-off rate and current without returning to the generator.

GENERAL ELECTRIC

NEW G-E Strikeasy LH-1 electrode adds metal powder to low-hydrogen coating for speed, ease-of-use, x-ray quality



Consider the payoff qualities you want in an electrode as representing the three sides of a triangle: speed, ease-of-use, and x-ray quality. Frequently, an electrode which is fast and easy to use does not deliver the highest quality—and vice versa. So, the triangle has unequal sides.

Now, with General Electric's new Strikeasy LH-1 electrode, you get the closest approach yet to the perfect triangle, the perfect electrode. You get the quality you expect from low-hydrogen electrodes plus the speed and ease of use that have given powdered-metal electrodes wide acclaim.

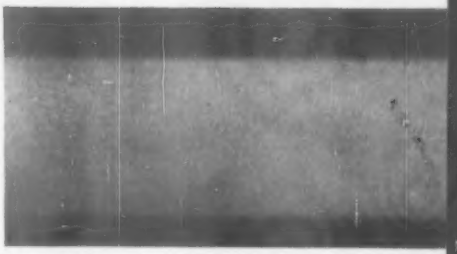
And Strikeasy LH-1 electrode speeds deposition rates up to 61% over conventional E-6016 electrodes—by actual test.

For more information on G-E Strikeasy LH-1 electrode, send the coupon shown below.

Your G-E welding distributor is located near you for fast local service. Ask him about G-E Fillerarc equipment and Strikeasy LH-1 electrode. His name is listed in the yellow pages of your phone book under "Welding Equipment, General Electric."

Progress Is Our Most Important Product

GENERAL ELECTRIC



X-RAY QUALITY is inherent to the low-hydrogen coating. Bad spots in base metal are absent from the weld.

G-E STRIKEASY LH-1 ELECTRODE	6.58 Lb Per Hr	
CONVENTIONAL E-6016	4.08 Lb Per Hr	INCREASE OF 61 %

($\frac{3}{16}$" electrodes used in test)

HIGH SPEED of Strikeasy LH-1 is due to metal powder. (Optimum current, ac: Strikeasy, 300 amp; E-6016, 225 amp.)

DRAG TECHNIQUE natural to powdered-metal electrodes speeds deposition, training. Slag is almost self-removing.

Section A710-21, General Electric Co., Schenectady, N. Y.

Please send me the bulletins checked below:

- ☐ GEA-6028 and GER-903—Fillerarc Equipment
- ☐ GED-2483 and GEC-1231—Strikeasy Electrode

NAME.....

TITLE..... COMPANY.....

STREET.....

CITY..... STATE.....

ESTABLISHED 1916

Welding Engineer

FEBRUARY, 1955

American story . . . in process

FOR the first time in at least 15 years, WELDING ENGINEER has a guest editorial writer. R. L. Townsend, of Tweco Products Co., Wichita, Kan., sends a monthly "Twecoletter" to welding supply distributors throughout the world. His Jan. 4 letter was devoted to the recent change in ownership of this publication. Naturally, we appreciate his comments and would like to share them with our readers. Here they are:

Almost 40 years ago . . . a man by the name of Mackenzie founded something new for a then struggling infant industry. The "infant" was lusty and had much promise to those with foresight but created never a ripple in the mind of the average man. At that time, there was no such thing as a welding supply distributor, at least not in the sense of the word as we know them today.

THIS man, Mackenzie, recognized the need for a medium to tell the world about developments in the welding industry which, at that time, was recognized for little more than its value as a repair tool. The editorial in the first edition of WELDING ENGINEER, Vol. 1, No. 1, dated January, 1916, is headed "A New Street in Our Town." Here is what Mackenzie had to say:

"Streets are avenues of communication. By means of them, people are able to travel to their destination. In olden days, folks depended upon cross-lot trails—the means of communications being both tortuous and uncertain.

"The welding field, so far as the transmission of information is concerned, has been in something like the same position as the frontier settlement—dependent upon cross-lot avenues of communication.

"Welding has come to be a most important branch of mechanics. By means of welding, by one of the several processes, whole industries have been revolutionized. The growth of the welding industry, during the last few years, should not be attributed to a wave of prosperity which has swept over this country but rather to the fact that welding, by *some* process, is an efficient and economic practice.

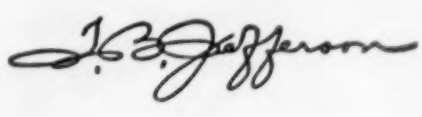
"We may confidently expect the field to expand, and, certainly, a powerful aid in the enlightenment and expansion of any industry is a strong, fearless, well-constructed trade paper.

"It requires time to build a really first-class paper, but, we believe, the broad gauged enthusiasm which prevails in the welding industry has made it possible for us to present you with a good paper in jig time."

It is doubtful if Mackenzie's 1916 vision encompassed as much as the welding industry has taken over today. This we will never know because he passed on a good many years ago, but his WELDING ENGINEER has lived on and prospered . . . Mackenzie's widow was fortunate when her path crossed that of Ted B. Jefferson, fresh from conquering the welding problems of equipment maintenance at the great Fort Peck Dam. His engineering degree, from Kansas University, didn't hurt him any. We now enter, as Editor of the WELDING ENGINEER, Ted Jefferson, fearless writer of editorials, the man with a firm conviction that welding is good for the country.

From the early forties until now, Ted has done an editorial job, under the Mackenzie and McGraw-Hill reigns, that makes welding people proud of him. Now . . . our friend takes over as Owner, Publisher, and Editor. Congratulations, Ted. Keep up the good work. Help welding to grow.

WE ARE happy that, under our direction, this magazine has won such friends as Ray and the many others who have phoned, wired and written us (see page 34). We shall try to continue to win and please those interested in welding.



Using a VICTOR No. 310 torch butt with two S2 extensions and No. 8 type 4 tip, Joe Wyman (Shreve Welding Co., Oakland, Calif.) repairs cast iron heating boiler header with VICTOR No. 1 low fuming manganese bronze rod. Inset photo shows 5/64" build-up on undersize castings, done with same No. 310 torch but with No. 5 type 4 nozzle and VICTOR No. 6 square cast iron rod.

VICTOR'S wider work range pays off from the day you select your first VICTOR welding outfit on through a lifetime of reliable service. You buy the torch you need for your present work, add extensions, cutting attachments or special nozzles as they're needed. Result: top-quality equipment that's always perfectly matched to your needs!

Whatever the job . . . welding, cutting, heating, brazing, descaling . . . you'll start it quicker, finish it sooner with versatile VICTOR equipment!

VICTOR for welding

LOOK FOR THE VICTOR DEALER SIGN *. . . ask him to show you why it costs less to own and operate VICTOR.*

VICTOR EQUIPMENT COMPANY

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Mfrs. of welding & cutting equipment; hardfacing rods; blasting nozzles.

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SAN FRANCISCO 7

No more long lines of cars

Third Lincoln Tunnel tube underneath the Hudson River is expected to relieve rush-hour traffic congestion. Muck and silt of the river bed will be pushed aside by a new welded cutting tool, a 240-ton steel shield that stands as high as a three-story building.

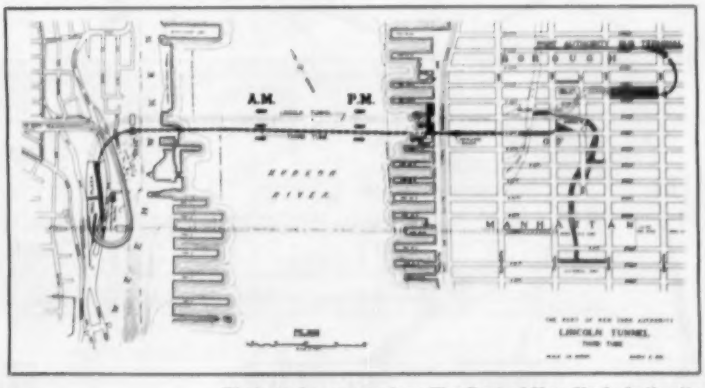


Photo and map courtesy The Port of New York Authority

BY HERMAN C. PHELPS

THE $1,000,000 third tube of the Lincoln Tunnel, which links New Jersey to Manhattan Island at 42nd St., will be completed early in 1957 by the Port of New York Authority. Iron-powder electrodes and submerged-arc welding were called upon to play important parts in the fabrication of the 240-ton shield that will bore the third passage underneath the Hudson River.

The shield stands nearly three stories high or exactly 31 ft 8 in. in diameter and 18 ft 4 in. long. It functions like a gigantic cookie cutter in slicing through the muck and silt below the bottom of the river. The "big push" comes from 28 hydraulic jacks with a thrust of 200 tons each. These force forward, 32 in. at a time, the cast-steel cutting edges that surround the forward edge of the shield. About 80% of the muck and rock is pushed aside, while

the remaining 20% is taken inside the shield to be hauled away.

PLATE WALLS TOTAL 3 IN.

The 18-ft-long steel tube that is the tunnel shield was made by joining together longitudinally ten curved sections, each the full length of the shield. The plates were rolled and partially welded at the American Locomotive Co., Schenectady, N. Y. The field welding at the tunnel site was done under direction of Craftsman Welders, Inc., Brooklyn, N. Y. General contractors for the tunnel building are Mason - Johnson - MacLean, Weehawken, N. J.

The shield wall has a total thickness of 3 in. Since 3-in. steel plate cannot be readily handled, the wall was made by binding three steel plates together. The outer plate is 1¼ in. thick, the center plate also 1¼ in. thick and the inner plate ½ in. thick. In previous tunnel shields, the separate "skins" were held together by rivets. This time it was decided that a better, faster job could be done by means of plug welding.

The ½-in. inside plates and the 1¼-in. center plates were plug welded together at the shops of the American Locomotive Co. These partially welded sections and the plates for the 1¼-in. outer layer were shipped to the construction site at Weehawken, N. J., where they were lowered, plate by plate, and set on idler rolls at the bottom of a 55-ft-deep excavation in solid rock.

As each plate was lowered to the bottom of the excavation, it was bolted into place. When the shield was fully assembled, four weldors swarmed over the top of it and started the job of plug welding the outer hull to the 1¼-in. center layer. There were 308 plugs, each requiring the filling of a hole 2 in. in diameter by 1¼ in. deep. To fill a single hole took approximately four ¼-in. electrodes 18 in. long. The welding was done at 300 amp, d-c, reverse polarity.

Here is the unusual part: the holes were filled with deposits from two different types of electrodes. In making the first weld, a fillet around the edge of the base of the hole, an E-6012 electrode was used. To fill the hole the rest of the way, however, an iron-powder electrode was employed.

The initial pass with an E-6012 electrode gave a good, strong joint between the two plates. After the weldor had placed a fillet around the inside of six plugs, he stopped welding, chipped off the slag and blew it out with an air hose. He then changed electrodes and filled, intermittently, the holes the rest of the way with iron-powder electrodes.

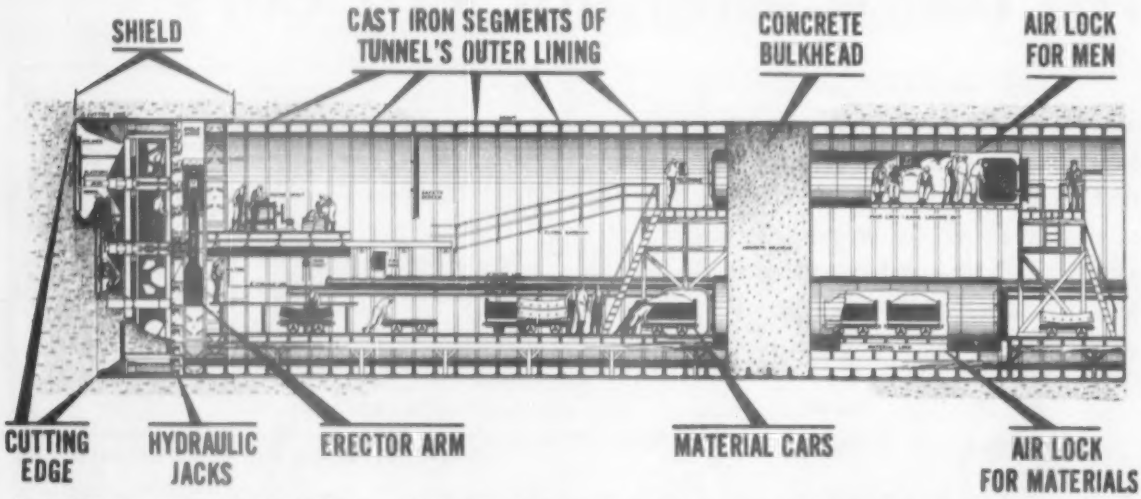
To control the difficulty of flux bubbles interfering with the arc, the weldor only melted about one-third of the 18-in.-long electrode in one hole. He then proceeded to another hole. By the time he had partially filled up all six, the slag would start popping off by itself from the first welds. Any slag still sticking was blown out with the air hose.

For the next and succeeding deposits, only half a rod was melted at a time. The welding was continued in this intermittent manner until each hole was completely filled.

Arne Jacobson, superintendent of Craftsman Welders Inc., reports that the men really "love that rod" even though not one of them had ever used powder-coated electrodes before. As soon as the men had been convinced of the proper position to hold the new electrodes, welding proceeded at a fast clip. Timing one type against the other, the powder-coated rods proved 50% faster on this job—due largely to the difference in time spent for slag removal.

The only difficulty experienced was to teach the six weldors to use a "leading" technique in holding the rod. The leading technique was necessary to keep the flux from piling up ahead of the arc.

All longitudinal seams (there were no circumferential seams) were weld-



ARTIST'S conception of third-tube tunneling shows how the 18-ft-long tunnel shield will be driven under the Hudson River like a gigantic cookie cutter. At left is shield with attached steel cutting edge. Shield is pushed through silt in 32-in. shoves from the 28 giant jacks at rear. Also at rear of shield, an erector arm pivots about center of 31-ft tunnel to place cast-iron segments into tunnel's outer lining. Segments are bolted together through flanges on their inner edges. Each tunnel ring consists of fourteen 1½-ton, 7-ft-long segments and a small key or locking segment. To right of shield, a solid concrete bulkhead is installed inside the tunnel lining to retain compressed air in the forward working chamber. Shield is pierced by four air locks, allowing men and materials to enter and leave working chamber without loss of air pressure.

PLUG welding ¼-in. outer "skin" to tunnel shield; powder-coated electrodes speed filling of plug holes

OUTSIDE longitudinal seam is submerged-arc welded after tube has been positioned to bring seam to top

ed by a submerged-arc welder after the plates had been positioned at the top and bottom. There were ten seams on the inside and ten on the outside. The inside seams were the only welds on the inside part of the shield to be made at the site. Ten passes with 3/32-in. wire at 620 amp and a travel speed of 12 ipm were required. Because of the space needed for the hydraulic jacks, the inside seams were only 7 ft long. The outside seams were 16 ft long and required seven passes to fill.

Craftsman tried the automatic machine on the plug welds, too, but the slag just bubbled up in the holes. When the arc hit deep slag, the machine produced only slag bubbles.

Tunneling Slow Going

Here is how the completed welded shield will be used for tunnel boring:

After each 32-in. thrust from the 28 hydraulic jacks, "sand hogs" will remove the muck and silt entering through doors in the shield face. When the shield is clear, they will assemble fourteen 7-ft cast-iron ring segments in the tail portion. The completed rings are 31 ft in diameter by 32 in. wide. The ring segments are thrust into place by a hydraulically operated erector arm attached to the rear of the shield framework. Pneumatic tighteners bolt the segments together, and a small key device locks each segment into place. As fast as a ring can be bolted and locked into place, the hydraulic jacks are braced against it to make another forward push.

The sand hogs are the key figures in the most elaborate plan so far devised to make tunnel boring safe. Working underground, mostly at a depth of 75 ft and always under pressure, they will burrow through the mud, rock and silt below the bed of the Hudson River. The silt in the river bottom is in a semifluid state and under pressure, both from its own weight and from the weight of the water above. To offset this pressure from outside, compressed air is forced into the tube.

A concrete bulkhead is installed inside the cast-iron lining ring to maintain air pressure in the tunnel. This bulkhead has an emergency air lock, a man air lock and two muck locks. While the shield is tunneling through the river silt, its front is blocked off except for hydraulically operated muck gates. These allow controlled amounts of silt to ooze into the tunnel. To offset the buoyancy of the incompleted tunnel, the silt is distributed along its bottom.

It will take the average driver only four minutes to make the trip through the yellow-tiled, fluorescent-lighted underground passage, but it will take the 200 sand hogs who are making the first crossing about fourteen months to complete their journey. Once underground, the sand hog will dig, blast and drill four shifts a day, six days a week. John M. Kyle, Chief Engineer for the Port Authority, is responsible for the overall third tube project. Resident Engineer, H. A. Druding is in charge of the job of tunneling until it reaches the New York side. An extremely capable fellow, Druding fits the picture of the hard-helmeted, khaki-clad tunnel boss. He knows tunnels well because he's been building them since 1932.

Druding's tunneling background covers the construction of both existing Lincoln Tunnel tubes, including the final lining surveys and checking line on both tunnels. Engineers must be extraordinarily accurate in keeping the tunnel on the right course as they push forward under the river. The survey party goes underground, checking and rechecking the tube's alignment after each shove of the shield. In New York, the third tube will go between the big concrete supports for the West Side Highway, with only about a 6-ft clearance.

In building the first two Lincoln Tunnels, two shields were used. Each was started from opposite sides of the river and met in the center. The engineers were right within a half-inch of their target—a margin about the size of a dime!

The third tube employs just one shield, which will be pushed on through to New York City until it enters rock. Boring through rock, of course, necessitates an entirely different type of construction. The tube will terminate just East of 12th Avenue on West 38th Street.

Strange Things Can Happen

The first tunnel under the Hudson River was started in 1880. This was a private enterprise and was plagued by floods and bankrupt financial backers. It cost the lives of 29 sand hogs in one accident alone and was not completed until 1904—24 years later. The men were drowned because of the always present hazard—a drop

(Continued on page 44)

HOME of Weldor John Patricia at Sussex, N. J. The metal palm tree causes passing motorists to stop and gape

TV antenna, car port posts and chain support for back door roof are all welded. Children are Patricia's daughters.

They built their welded home

BY CLYDE B. CLASON

THE ways to acquire one's own home are many and varied. Some save and scrimp for it; many take the shortcut of a second mortgage; a few artistically inclined draw their own plans and save architect's fees; a very few resolute souls will act as their own contractor and take on all the headaches that involves. But almost no one builds his own home with his own hands.

A startling exception to the last statement is John Patricia, of Sussex, N. J., 38-year-old weldor employed by the Sintering Machine Co., Stanhope, N. J. He and his wife did practically everything themselves. Their only outside labor was one mason employed to level off the concrete floor slab, and he put in only one day at the job. Everything else is the work of John and Carrie Norma Patricia.

Cottage in the Country

Patricia is one of those all-around weldors, so handy to have around a shop, who can weld any metal and tackle any kind of job. A native of New Jersey, he has a background of 12 years of welding, including five years in his own business and shipyard experience during the war. Patricia bought an attractive home site on Route 23, about three miles north of Sussex, in the northwest New Jersey lake country. The purchase of their large lot, however, about exhausted the Patricia's savings. If they wanted a house to stand there, they would have to build it.

Being a weldor, Patricia thought naturally in terms of welded steel instead of more conventional bricks-and-mortar or wood framing. He knew that he could build a welded steel framework, and he figured that after that it wouldn't be too big a job getting up the walls and the roof. Details like plumbing, wiring and heating plant, he took in stride.

As it now stands, the Patricia home is a one-story, glass-front, flat-roof structure containing living room, kitchen, two bedrooms, a large bath-

room, laundry room, home workshop and utility room, a hallway and a car porch. It is the perfect size to hold Mr. and Mrs. Patricia and their two small daughters, Regina Ann, age 10, and Renée Marie, age 5.

The house is 32 ft wide and 52 ft long with an 8-ft ceiling. It has no basement. The floor is a one-piece concrete slab set over a crushed stone foundation, with linoleum laid over the concrete. The structural members of the walls are 3-in., 4.1 lb. channels. White pine was ordered cut to fit the openings of the channels, and this lumber provided "nailers" for the insulation and exterior wall. The ⅞-in. thickness of insulating material gives the house a vapor seal. Over the insulating layer goes a 1½-in. thickness of white pine in 14-in. board widths. The pine is not painted but varnished, to preserve the natural texture of the wood.

Inside, the spaces between the backs of the vertical channels are filled with 6 in. by ⅞ in. panels of knotty pine. The channels themselves are not covered by the pine panels but are painted with red oxide, varnished and then left as part of the interior wall. They harmonize very well with the ceiling, which is also supported by 3-in. channels, crossed by ⅛ by 3 in. flat bars. The channels run from front to back of the house, the flats from side to side. Both are painted with red oxide and varnished, as is the steel sheet immediately above them.

The ceiling itself is mostly of 14-gage sheet steel, although some 11-gage sheet had to be used when 14-gage was unavailable. Another ⅞-in. layer of insulation was placed above this, and then the material for the roofing. The roof, though it appears flat from outside, is actually slightly concave. Its drainage is inward, into water pipes that are led through the inside of the house and out to Mr. Patricia's duck pond. Valves and faucets allow the drainage water to be tapped should there be a need of it for laundry or other purposes. The main reason for this type of roof drainage, however, was to avoid the expense and labor of installing gutters.

Easy Air Conditioning

Patricia, who is, as you may have guessed by this time, a very ingenious fellow, has also installed a sprinkler system for cooling off the roof on the real hot days of summer. The idea is the same as that of an attic fan: cool the space above your head and the temperature will drop. It works so well that the temperature recorded by a thermometer inside the house was around 70 F when the outside thermometer showed 90 F.

Home cooling and heating is greatly facilitated by the fact that all of the windows, except those of the bathroom, are sealed shut. Patricia's theory of a window is that it is a nice thing to look out of. Eventually, he will have forced-air ventilation.

Patricia also built his own heating plant, and thereby hangs a story. His "furnace" is a wood-fired boiler connected to a chimney of 6-in. well casing that is welded to the roof. A jacket is welded on to the chimney and heats water from heat that goes up the chimney. Hot water is pumped through pipes running around the floor boards of the house and back to the boiler-jacket to be reheated. The radiators are convectors made of 4-in. channel boxes and ¾-in. galvanized pipes. To provide a wider surface for heat exchange, each channel box contains four lengths of pipe. This home-made welded heating system works so well that the house is warm on the coldest winter days, and there is no condensation inside.

The reason that wood is used for fuel is because of its availability and cheapness in this particular rural area. Eventually, Patricia plans to have an oil burner, and he has gone so far as to construct a 550-gallon tank for oil in his front yard. Welded, of course.

Mrs. Patricia helped her husband to raise steel and did other jobs of back-breaking nature that were required in the building of their unique house. She tried her hand at welding, too, but could not seem to get the hang of it. Her husband, though, pays high tribute to her abilities as a steel erector. "She has never gotten discouraged or caused me to get discouraged," he says.

To give an idea of the magnitude of the job undertaken by this ambitious couple, a few dimensions might be in order. The living room and kitchen are each 10 by 16 ft. The two bedrooms are each 10 by 14 ft. The bathroom (which will get a paragraph of its own in a minute) is 7½ by 10 ft. The laundry room is 10 by 10 ft, and the workshop-utility room 10 by 20 ft.

EVERLASTING tulips border the front walk. Stem of each flower is a length of broomstick; stalk a 5/32-in. electrode; leaves and petals cutouts of sheet aluminum

Bathroom in Steel

The 7½ by 10 ft bathroom is in many respects the most unusual room in the house. Its walls and ceiling are all of 14-gage sheet steel, painted in blue enamel. The panels are bolted together, and the joints calked with a calking compound to provide watertightness. The bolted construction was used, instead of welding, to allow the walls to be removed. Should the Patricias ever decide to alter the dimensions of their bathroom, its walls can be knocked down with little trouble.

The bathroom contains a built-in steel closet, 24 by 30 in. by 4½ ft high, and a built-in hamper, 24 by 30 in. by 3½ ft high, into which clothes are dumped and taken out from the other side of the wall near the electric washer. A mirror frame, 4 by 7 ft, was made from 3 by 3 by ¼ in. angles that are bolted to the steel wall. Four steel shelves are also installed above the customary bathroom conveniences — each of these shelves is 6 in. wide and 7 ft long. A built-in steel shower stall might also be mentioned.

About 5½ tons of steel were used for this unusual home, and it was flame-cut to proper lengths as needed on the job site. Though a handy man with the cutting torch, Patricia does only arc welding. His first act of home-building was to truck his 300-amp d-c welder to the construction

PATRICIA built his own furnace, too. It has a welded stainless-steel jacket and also heats water by hot air normally lost going up the chimney

HOT water is pumped through system of welded pipes running around floor boards. House is kept warm on coldest days, and there is no condensation

site, and it is still there at the back of the house and is used constantly. Just as the busman is reputed to take a bus ride for a holiday, so Weldor Patricia goes welding whenever he has a day off.

Ducks and Tulips

The things he has built can be seen all around the grounds of the house. The duck pond has welded steel ladders up which the ducks waddle to reach barrel houses. They lay and hatch their eggs, and the ducklings crawl down the ladders into the pond —at least they get to the pond almost immediately after emerging from the eggs. Mrs. Patricia admits that she has actually never seen any ducklings using a ladder.

Last Christmas Patricia amused his two daughters very much by building a rocket ship for Santa Claus made of steel rings and aluminum sheet. Santa was there, too, and eight wholly unneeded reindeer were lying down in front of the rocket ship.

There will be flowers around the house even when snow falls, for Mrs. Patricia has a border of everlasting metal tulips along the winding drive leading up to her home. The stem of each flower is a piece of broomstick painted green; the stalk is a 5/32-in. welding wire, also green painted; and the leaves and tulip petals were cut from sheet aluminum and painted in appropriate colors, the flowers being mostly red-and-white and yellow-and-white. A second 5/32-in. welding wire is inserted in the bottom of the broomstick stem to root the metal flower into the ground.

Patricia's rural mailbox is supported by a length of large chain, the twenty 2½-in. links of which are welded together to form a rigid post. Two lengths of similarly welded chain (thirty 4½-in. links) serve as pillars for the back porch. By welding links of tire chain (a very tricky job, indeed), Patricia produced a sign with welded letters to spell "WELDING".

Naturally, this all-around welding expert built his own television tower. He had a 100-ft triangular tower all welded on the ground and then found out there was no way of erecting it. No whit dismayed, he chopped off a 50-ft length, which could be erected, and cut up the rest into supports for a clothesline and pillars for his car porch. Incidentally, Mrs. Patricia probably has the sturdiest and best

built clothesline to be found anywhere in the state of New Jersey.

Monkey up a Tree

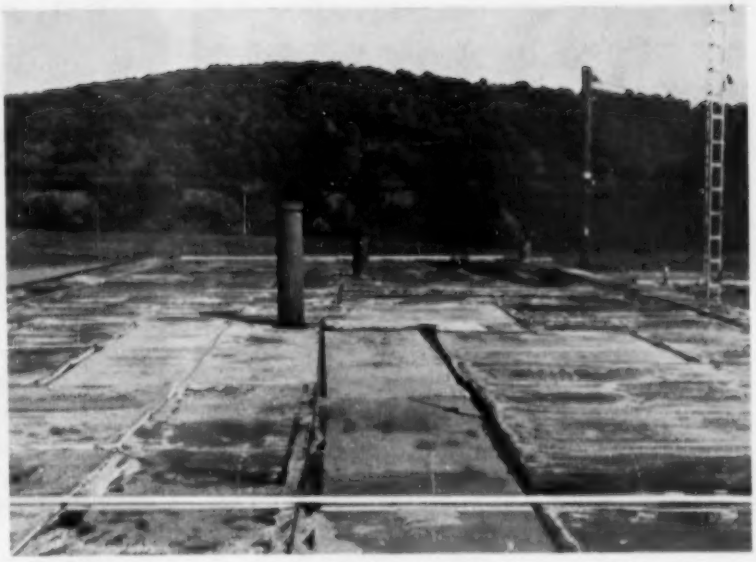
Patricia's latest project is an ornamental palm tree. Its trunk is of 16-gage rolled steel plates, to which large aluminum palm leaves are bolted. When raised at the front of the house, the tree was completed by actual coconuts and a metal monkey. It should attract lots of attention in the wintertime when snow is on the ground.

A more practical product than the monkey is a welded steel hoist to handle the 300-amp welder. Every now and then Patricia had to take his machine out on the job. He has a truck to transport it, but the big welding generator is too heavy for a single man to lift, and neighbors never seem to be around when you have something to do of this nature. Patricia built himself a hoist, and he can now put the welder in the back of the truck or take it out of the truck unaided.

To return to the house itself, your writer tried conscientiously to get some facts and figures on the welding man-hours needed for its construction. That proved to be impossible: when they built their home, the Patricias were far too busy to keep records. Furthermore, since they only worked on it at odd days now and then, it was hard to remember just how much welding was done. About the only figure of which John Patricia is sure is that he could do 90 ft of welding a day on the 14-gage roof. He estimates, however, that if another such house were to be built as a full-time project, he and one helper could get the steel up in two days and have all of the welding done in another eight or nine days.

E-6010 electrodes were used to weld the joints of the sheet members, and E-6013 electrodes on the structural steel. For the latter, the current setting was in the 50-60 amp range; for the channels, it was around 120 amp. No welding problems at all were encountered.

Patricia, it should be noted, has applied for a patent on his particular method of steel construction. He hopes that some day he may be able to go into the business of building steel-framed homes for other people. In this event, he plans, the steel would be delivered to the job site saw-cut to the proper lengths, and other labor-saving innovations used.



INSULATION on the roof curls up when the sprinkling system is turned on. Water evaporation from room will cool the house 20 deg in two hours

CEILING supports are 3-in. channels crossed by ⅛ by 3 in. flat bars; both painted with red oxide and varnished. Wall panels are of white pine

1—TEN long spokes and inner ring are loaded into fixture for first operation on simulated wire wheel

2—ONE stroke of a multiple-electrode three-phase welder joins the spokes to the inner retaining ring

Cross-wire welding with multiple electrodes

3—THIS spiderlike subassembly is produced by the first operation

SIMULATED wire auto wheels posed a real production problem for Casco Products Corp., Bridgeport, Conn. The design required 40 spokes of type 430 stainless steel to be joined to two stainless-steel retainer rings. Type 430 is a ferritic or non-hardenable straight-chromium steel containing from 14 to 18% chromium. Though it can be resistance welded successfully, it requires less heat than for the same gage thickness of carbon steel because of its lower heat conductivity, lower melting point and better surface condition.

Accurate fit on the automobile wheel demanded precise alignment of the entire assembly. In order to withstand the shock of vibration of driving at high speeds, all the joints had to have maximum strength. A very high production rate was required in order to satisfy contracts and maintain an attractive selling price.

All of these requirements were met by using two three-phase welders with special tooling for multiple-gun operation. The spokes are formed and sheared in two sizes on a press. The inner and outer retaining rings are curled and sheared to size on a circle. The 42 parts—40 spokes, 2 rings—are joined together in just four operations to make the complete wire "basket".

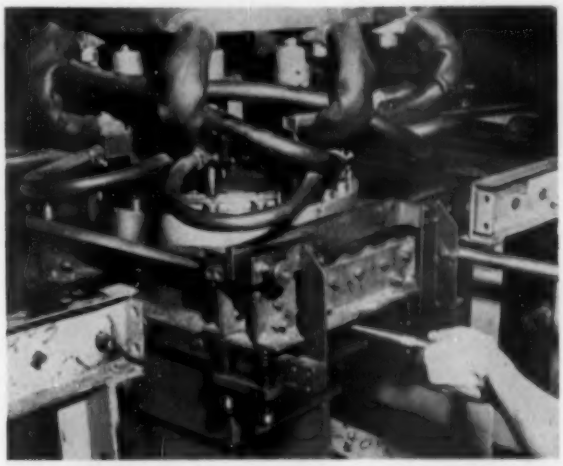
Operation one (pictures 1, 2, 3): Ten of the long spokes and the inner ring are loaded in a fixture for welding. The spokes are joined to the inside ring. The subassembly thus fabricated is joined to the subassembly fabricated in the second operation.

Operation two (pictures 4, 5, 6): Ten long, ten short spokes and the outer retaining ring are loaded into another type of fixture. Two welds are required. The weldor joins the ten long spokes on the first weld, after which the electrodes are manually indexed and the ten short spokes are joined with the second stroke.

Operation three (not pictured) combines the subassemblies of the first and second operations with one stroke of the welding electrodes. Again, the electrodes are manually indexed.

Operation four (pictures 7, 8): The ten remaining short spokes of the wheel are welded in place with one stroke. The basket assembly is now complete. All twenty of the long spokes are joined to both the inner and outer retaining rings. The twenty

4—TEN long and ten short spokes and outer retaining ring are loaded into fixture for second operation.



5—WELDING is done in two strokes: first to join the ten long spokes and then for the ten short spokes

short spokes are joined only to the outer retaining ring and are set behind the long spokes. The short spokes are held against the inner ring by their own tension without any welding. The three-dimensional effect thus produced adds greatly to the realism of the simulated wire wheel assembly.

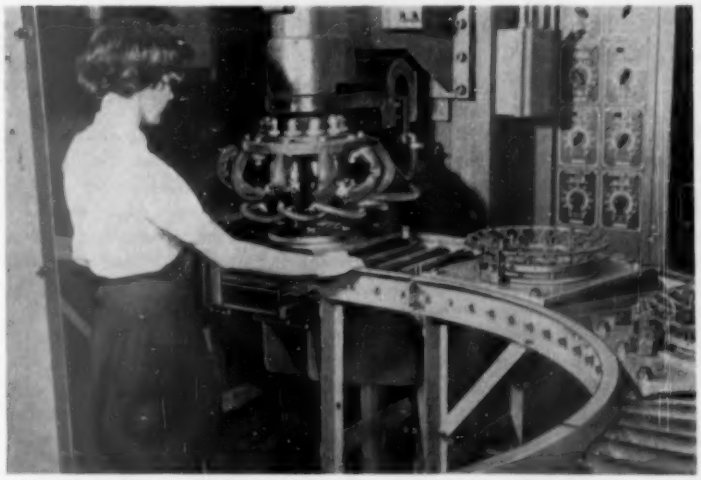
Several sets of the three fixtures required provide a continuous flow of work to the welders and enable the production of over 1,000 welded assemblies a day. The fixtures are moved through the various operations on a continuous roller conveyor. Because the welder controls are preset, skilled workers are not required to maintain the production and quality of the complicated assembly.

Every 5 to 8 minutes a completed assembly is taken from production for inspection. To insure fit and make sure there is no rattling nor vibration when the wheel is on the car, a number of tolerances must be maintained. The assembly must be precisely aligned; the inner and outer ring must be truly parallel and separated everywhere by a constant distance. The amount of set-down must be constant and within rigid specifications.

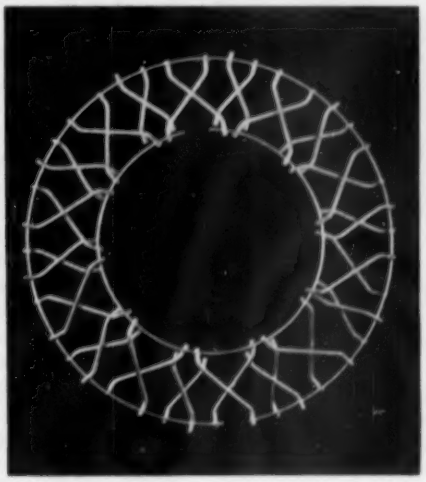
The inspection includes radial positioning of the spokes to assure fit of the completed basket into notches of the hub plate and outer dress ring.

Photos courtesy Sciaky Bros., Inc.

6—SECOND subassembly produced by the second welding operation



7—AFTER the two assemblies shown in pictures 3 and 6 have been joined, the fourth operation completes welding of last ten spokes



8—COMPLETED "basket" for wheel after the last operation, shown in picture 7

1 Inspectors check shipment. Interior is examined by a borescope; exterior by fluorescent penetrant

2 After degreasing, pipe is flushed and drainings are checked for presence of degreaser compound

No stubs or butts in this pipe!

Rigid and methodical inspection is made of the pipes that carry nuclear fluids aboard atomically powered submarines *Nautilus* and *Sea Wolf*. A weld is rejected if it would allow a gas leak of a cubic centimeter in 30 years.

WELDED pipe section leaves the Electric Boat shops for installation aboard an atomic submarine. It is capped to guard against possible entrance of any foreign material. Test men will repeat pre-inspection test processes aboard submarine after the piping has been installed

SOME welding shops find it difficult to keep electrode stubs, old brushes and cigarette butts off the floor and out of the products. The sloppy shop would be amazed at the cleanliness and exactness that is required at the Electric Boat Division of General Dynamics Corp., Groton, Conn.

The welded pipe that will carry radioactive fluids for the nuclear reactors of the submarines *Nautilus* and *Sea Wolf* is fabricated under conditions designated "Grade A" superclean. The welding and testing of the pipe is done in a room that rivals operating rooms in freedom from contamination by dust, dirt, crud and grime. The walls, ceilings and floors are vacuum cleaned several times a day. The air entering the room is filtered. Visiting is kept at a minimum; only those whose visits are necessary are allowed to enter the welding room. And anyone who does enter must wear rubbers over his shoes and put on white coveralls.

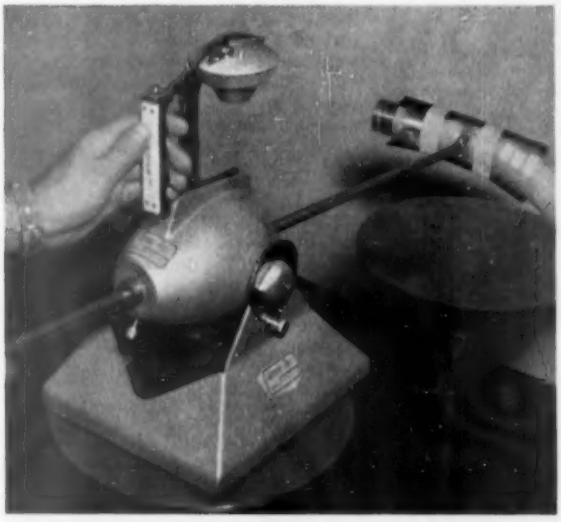
To insure perfect cleanliness of the product, the type 347 stainless-steel pipe is given several physical checks as it is received at the Electric Boat test laboratory. After a record has been made of the chemical analysis, lot and heat numbers, the exterior surface is inspected by a fluorescent oil penetrant, using "black light" to reveal the hidden flaws. At the time this is done, the interior is scanned for pits, burrs and other imperfections with a borescope.

From the inspection laboratory, the pipe goes to another building for a degreaser bath and rinse. As the drainings are flushed out, they are checked by conductivity test and titration for presence of the degreaser compound or other adulterants. The pipe then goes to the "clean room" for welding and testing. Weldors are required to wear clean, lint-free coveralls and handle all pipe and rod with nylon gloves only.

Before welding, the ends of each stainless-steel pipe are sealed to guard against the possibility of any dust or grit entering. Inspectors look

3 What's wrong with this picture? Weldor is *not* wearing the nylon gloves required during welding

4 First test is a dye-penetrant check of weld. The inspector at the left is making a written record



5 Next test is a gamma-ray inspection. In this picture, the ray source is radioactive iridium-192

6 Final test is to plug pipe at both ends and use a mass spectrometer to detect leakage of helium

it over and attach a tape to the exterior to indicate that the pipe is clean enough to weld.

After welding, the first of a series of tests is made, a dye-penetrant check. After this, the welds are radiographed. Usually iridium-192 is the ray source, but sometimes cobalt-60 or mobile 250-kv and 150-kv x-ray machines are used. The iridium source, however, gives sharp, easy-to-interpret pictures on material up to 2½-in. thick.

For its final test, the pipe is plugged at both ends, and helium is pumped into it to a pressure of 100 psi. Then a mass spectrometer is used to check all welds. So thorough is this probe that it will detect any leakage of helium at the exceedingly low rate of one cubic centimeter—0.06 cu in.—in thirty years. If the weld leaks even this insignificant amount, the pipe is rejected. Welds have got to be good.

After the final inspection, the pipe is capped again against the possibility of contamination by foreign matter and is taken to the submarine for installation.

The record of inspections accompanies the pipe right through to the final installation aboard the submarine. This insures a close follow-up if pipe or welds fail. It is equally valuable in tracing a faulty lot of pipe and may also forestall serious failures in other installations where the same materials are used.

Equally thorough records are kept on each welding electrode and tools used on the job. This eliminates the possibility of foreign material or tools being inadvertently left in the assembly.

THANKS—a million for those reassuring words

The announcement of the change in ownership of WELDING ENGINEER has brought us many well wishes. While we cannot take the space to reprint them all, we want to share some of these gracious thoughts with our readers.—T. B. Jefferson.

All of us around here have been discussing the development, and we all feel that you can probably do a far better job under the new set-up than has been possible up to this time.

R. S. (Tommy) Thompson
Stoody Co.

We are glad to know of your change and wish you the very best of everything in your endeavor.

C. P. Morgan
Erico Products, Inc.

May I hasten to extend to you my heartiest congratulations and best wishes for a very successful undertaking.

Gus Emin
Bridgeport Brass Co.

I certainly want to congratulate you and express my sincere wishes for continued success as owner and publisher of WELDING ENGINEER. You have worked extremely hard on your previous assignments, and I know your hours will be even longer with this new responsibility. The amount of information I can add to your magazine is certainly meager, but if I can be of any help at any time, please do not hesitate to call upon me.

J. P. Coughlin
Eutectic Welding Alloys Corp.

I was really surprised to learn that you are now the new owner, publisher and editor of WELDING ENGINEER. Congratulations on your new venture, and I wish you the best of luck and success.

George L. Staudt
Harnischfeger Corp.

Please accept my best wishes for prosperity and success in your new venture as publisher of the magazine which you have so ably edited for so many years.

Allan L. Percy
Fansteel Metallurgical Corp.

Want to wish you the very best of success, which you well deserve.

George G. Glenn
Glenn Co.

We at All-State want to congratulate you and wish you all the success and happiness in the world on your new venture with WELDING ENGINEER. We feel that you deserve only the best, and you can rest assured that we will do our bit to further your success.

Richard H. Mandel
All-State Welding Alloys Co., Inc.

The news of the change of ownership of WELDING ENGINEER came as quite a surprise to me, and I am very happy for you. It is my wish that the best of everything comes to you in your new venture, and I will expect to hear from you anytime I can be of help to you.

L. F. Vonier
A. O. Smith Corp.

Congratulations! I can think of no one better qualified to do an outstanding job on this well recognized welding publication than you. I know I am merely expressing the best wishes of everyone here when I express my own sincere desire for your success in this venture.

C. B. Abel
Miller Electric Mfg. Co.

We were quite surprised and pleased to see that you had purchased WELDING ENGINEER from McGraw-Hill. You can be sure of our continued cooperation, as long as results are received, and we here at Rankin join in wishing you the greatest of success in your new venture.

Phil Welty
Rankin Mfg. Co.

Congratulations—now that you are the owner you can do many things that you could not do before. I am confident that under your direct management WELDING ENGINEER should get "bigger and better" each month.

Lou Stettner
Victor Equipment Co.

Congratulations from all of us, and we sincerely hope that you will be successful in the greater development of WELDING ENGINEER.

George L. Hammon
National Welding Equipment Co.

I think it is grand that you are taking over as owner and publisher.

R. W. Raney
A. O. Smith Corp.

My heartiest congratulations on your acquisition of WELDING ENGINEER. You have done an excellent job in the past as Editor—from the "Publisher and Editor" we shall look for truly great things.

James E. Norcross
Arcos Corp.

Congratulations upon becoming publisher of such a fine magazine. We can realize that this must have been a very momentous step to take, and we wish you every success with your new venture.

Arthur L. Phillips
Eutectic Welding Alloys Corp.

I am very much interested in your plans for WELDING ENGINEER. I think you are very right in carrying it on as an individual publication. You *are* WELDING ENGINEER to most people in the industry, and I am confident you will make it a profitable one-man paper. I wish you every success!

Henry G. Lord
McGraw-Hill Publishing Co.

The announcement concerning your recent acquisition of WELDING ENGINEER has come as one of the most welcome and pleasant bits of news in a very long time. I would like to be one of the first to congratulate you and to wish you the best of everything in your new venture. I feel sure that with your proven ability in the publishing field and with your will to succeed, the road you have chosen to travel will not be a difficult one; however, if at any time you should need a helping hand, please do not hesitate to call me.

B. E. Rossi
The Welding Journal

May I say . . . that we wish you a lot of success in this business and hope that it will be a very profitable move on your part.

Richard L. Sherwood
The Hobart Brothers Co.

I want to offer my sincerest congratulations, Ted, and to wish you and WELDING ENGINEER the very best in the coming years. Under your expert leadership and guidance, WELDING ENGINEER is going to continue to be the leading publication in the welding field.

N. N. Canfield
Smith Welding Equipment Co.

Frankly, as far as I am concerned, WELDING ENGINEER and Ted Jefferson have always been analogous. As a matter of fact, to me Ted Jefferson *is* WELDING ENGINEER; therefore, it is with the greatest of pleasure that I have the opportunity of congratulating you and wishing you the best success possible in this undertaking.

William Jetter, Sr.
Mid-States Welder Mfg. Co.

I want to congratulate you on your new endeavor and wish you the very best of success.

Carl F. Smith
The Sight Feed Generator Co.

May we extend to you our congratulations in taking over the ownership and the publication of WELDING ENGINEER. Wishing you a very successful and profitable 1955.

H. E. Piggott
Dockson Corp.

Just a short note to tell you that we have heard about the change in WELDING ENGINEER and that we wish you all the good luck and success in the world. Anything that we can do to help will be done.

E. C. Caluwaert
O.K.I. Welding Supply Co.

Congratulations!

Jerry Kemper
McCormick-Armstrong Co. Inc.

I have been informed that you have purchased WELDING ENGINEER. I wish to extend my heartiest congratulations and

trust you have a very successful venture. I know you have a great many friends in the welding industry who will do everything they can to help you make a go of it.

James N. Alcock
Saginaw Welding Supply Co.

I think you know all of us here wish you the best of success in your venture as a capitalist.

George F. Staley
Stoody Co.

I have just heard that you have bought WELDING ENGINEER and are moving it back to Chicago. I wish you the best of success in publishing this journal as an independent venture.

John F. Chapman
Harvard Business Review

You have done so much to place this magazine in its present position of importance to the welding business, and we are happy that from here on you should benefit personally by its success.

Bob Waldie
Williams and Co., Inc.

Congratulations on your new move. It's surprising what a fellow won't do to prevent being pulled away from his old home town. I know you will be successful because of your many friends, and I am proud to include myself in the list.

A. A. Bernard
Bernard Welding Equipment Co.

I was to glad to get your letter announcing the change in ownership of WELDING ENGINEER. I think that is just splendid, and more power to you. There is an old cliche—"it's couldn't happen to a nicer guy!"

Donald B. Botkin
American Hoist & Derrick Co.

Please accept my congratulations to know that again your child is under your direct influence and editorship. You have always been an outstanding editor in the welding field and your fine publication has contributed very much indeed to the spread of engineering information upon its favorite subject. Please be assured if there is anything we can do to be of assistance or help to you, we shall be only too happy to do so.

W. H. Eisenman
American Society for Metals

I certainly want to congratulate you on taking over WELDING ENGINEER from McGraw-Hill. I hope that you will make it even more successful than it has been.

Herbert Fredman
Phillips-Ramsay Co.

Just a note to wish you the best of luck in taking over the publishing of WELDING ENGINEER. I'm sure the publication will prosper under your capable leadership and will continue to fill industry's need for a practical engineering magazine.

H. R. Clauser
Materials & Methods

You have always done a fine job, Ted, within the realm, and to the extent that you could operate under big time management. I predict that WELDING ENGINEER under your ownership and direct management will thrive no end. My best wishes to you for all the luck in the world and that you may have complete success in this, your new endeavor.

E. A. Daniels
Victor Equipment Co.

Congratulations—best wishes and good luck.

A. H. Friese
Welding Engineering Co.

I am glad WELDING ENGINEER is now under your own management. Here's wishing you a lot of fun and success.

E. L. Mathy

We were delighted to receive the news of you and WELDING ENGINEER. I am confident that your continued efforts in directing this publication will be of even greater assistance to the welding industry than they have been in the past. Your statistical and market service has been of great help to us in planning our own programs in the welding market. We are glad to note that you will continue this work. You can be assured of our continued support and cooperation in this regard.

C. I. MacGuffie
General Electric Co.

Congratulations and best wishes for your continued success in your chosen profession as writer, editor, and now tycoon in all matters pertaining to welding.

A. E. Zeisell
Permalatem Welding Alloys, Inc.

We are pleased to learn of your assuming the control of WELDING ENGINEER, and, while we realize it will be quite a responsibility, we are confident you are the man who can handle the job.

E. E. Whitson
Ampco Metal, Inc.

Congratulations! To say the least I am happy for you in your acquisition of WELDING ENGINEER. You will probably immediately start working for less, but, as a boss, that is what you should expect.

Ray Townsend
Tweco Products Co.

I just saw the item in this morning's *Herald Tribune* which tells me that you have bought WELDING ENGINEER and are striking out on your own. I think that is wonderful, and I certainly wish you every possible success. If there is any way in which I or any other member of this firm can help you to make WELDING ENGINEER even more of a respected leader in its field, you know that you need only ask.

Lucien R. Grief
Jones & Brakeley, Inc.

Congratulations on your taking over your "first love," and I wish you every success.

Jack Honhart
Atlas Welding Accessories Co.

I read with both astonishment and pleasure that you had taken over the ownership of WELDING ENGINEER. Your decision to publish a welding magazine and make it stand on its own feet warms my heart. The rapidly expanding and growing welding trade is no longer part of a business but a business by itself. My sincere congratulations.

C. M. Burnett
Vickers Electric Division

Just heard the good news of your acquisition of WELDING ENGINEER. Congratulations and best wishes for success. Regards.

Rene D. Wasserman
Eutectic Welding Alloys Corp.

I do want to take this opportunity to congratulate you on your new venture and wish you all the success in the world, and it is no question in my mind but what WELDING ENGINEER will go further and become better than ever—after all, you made it what it is today.

E. D. Anderson
Tweco Products Co.

The good news that you will henceforth be Publisher and Editor of WELDING ENGINEER sounds like prosperity to me, and I want to wish you all success.

R. L. Lerch
Haynes Stellite Co.

I am certainly pleased to have this formal announcement of the change in ownership of WELDING ENGINEER and particularly pleased to see that you are going to return to Chicago. It will be good to have you back in "the group." Under your complete control, WELDING ENGINEER should flourish even more than it has in the past.

J. K. Calhoun,
The Bastian-Blessing Co.

I want to wish you the very best of fortune in the undertaking and to express my confidence in your undertaking.

Walter J. Brooking
Foote Mineral Co.

I was interested and pleased to see that you are taking over the operation of WELDING ENGINEER. All good luck and happy landings in your venture. I am sure with a free hand you will make this a bigger and better publication than it could otherwise possibly be.

A. F. Davis
The Lincoln Electric Co.

Congratulations and the best of luck. I am sure WELDING ENGINEER, with the help of your many friends and the knowledge you have of the welding industry, will prosper under your ownership.

E. O. Williams
Victor Equipment Co.

I want to wish you, as head of a publishing group which is acquiring WELDING ENGINEER, the very best of luck on this most exciting venture.

Paul L. Eden
Eden and Associates

I can understand the enthusiasm and excitement which must accompany this great milestone in your career, and I wish you everything in the way of success and happiness in this new venture.

W. R. Persons
The Emerson Electric Mfg. Co.

Three ways to cut costs of production weldments

1. Use the right material

2. Dimension parts for proper fit-up

3. Give Inspection the job of seeing that 1 and 2 are carried out

BY REX CLEVELAND

Design Engineer,
Minneapolis-Moline Co., Louisville

THE making of parts for production weldments divides properly into three phases: material control, dimension control including edge preparation, and inspection. Each of these three contributes to both the cost and the quality of the end product.

The upper 25% of the cost of production weldments stems from the many variables native to their fabrication and assembly. A large percentage of welding difficulties can be traced to parts which are improperly made or which are of the wrong material. Parts too long or too short, parts made of scaly or rusty steel, parts with improper edge preparation, or parts improperly shaped will decrease the efficiency of production welding and increase its cost.

1. Material Control

The weldor must be supplied with parts made of the correct material, and he must know its nature. High-carbon steel simply cannot be used where low-carbon steel is specified unless the welding procedure is changed. He must also have parts that fit, parts that allow for proper fit-up gaps and parts properly prepared for welding. Misfitted or mismatched parts increase welding costs and decrease quality. Parts with edges improperly prepared for the specified joint cannot be welded with high efficiency. For reasons such as these, it is extremely important that material and parts fabrication, and the inspection of both, be watched very closely.

At no point in the manufacture of products made from steel is the analysis and the condition of the material so important as in production welding. The importance of correct analysis cannot be overemphasized. Merely specifying the correct steel for the part is not enough. An error may be made in the requisition for purchasing; the purchase order may list the incorrect analysis; the steel manufacturer or warehouse may err in filling and shipping the order. There is, therefore, no real assurance that the steel received is the steel specified. It may even be color marked incorrectly. For these and other reasons, all steel should be carefully checked on receipt.

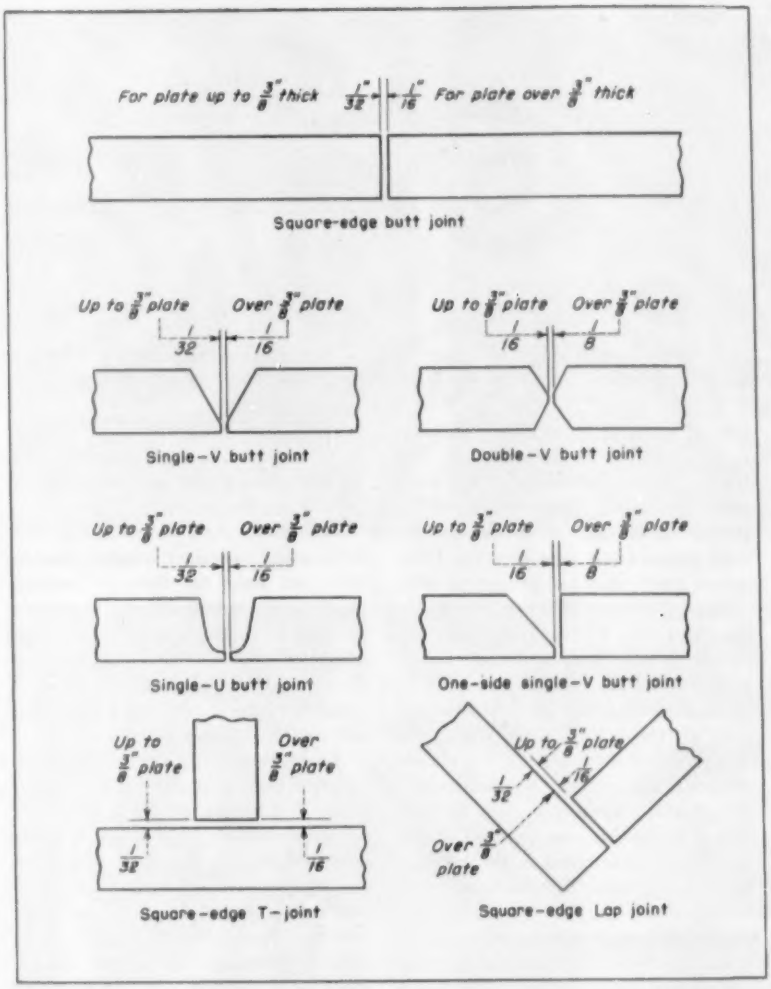
The only *positive* method of checking is by chemical analysis. Most firms, however, are not equipped with a laboratory for the analysis of steel, and the cost of such a procedure is far too great to be absorbed by any but the manufacturers using the highest tonnages.

The "spark test" is an excellent and economical method of steel analysis, which is quite satisfactory in most instances. A small sample of the steel in question is held lightly against a grinding wheel while the pattern, shape and color of the sparks produced are carefully noted. The carbon content and other elements commonly present in most steels can be readily detected by the pattern of the sparks. The presence of various elements affects the shape or color of the spark shower in characteristic fashion. Most engineering handbooks outline this simple method of analysis very clearly. With a little practice on samples of known analysis, surprising accuracy may be attained.

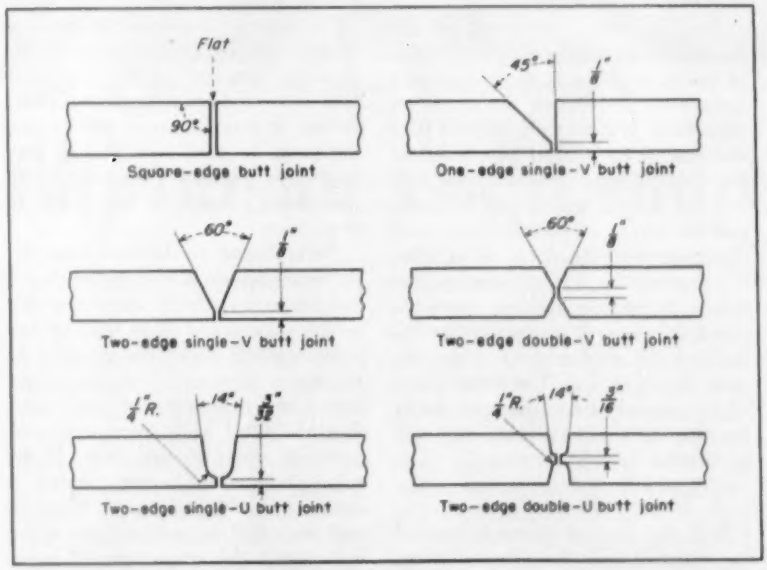
Checking of the steel analysis upon receipt is only the first step. Every time the steel is handled, the opportunity arises for confusing it with other steels being processed. To avoid this, a system of maintaining the identity of each lot of steel must be worked out. Color identification is lost in shearing or cut-off, so the trucks or bins of cut-off pieces must be clearly marked. The identification system must follow through each time an operation is performed on the parts so that there will be no doubt of their analysis when they finally reach the welding department. When substitute steels are used for any reason, an identification system becomes doubly important.

If the parts that reach the welding department are of the wrong analysis, the welding is begun not only with the wrong steel but with the wrong electrode and the wrong procedure. If the error is detected by the weldor or by an inspector immediately, it causes only momentary confusion, which is levelled off as soon as an analysis check is made. However, the procedure must be corrected, which is usually very costly. It is not likely that the substitute material is more weldable than the material originally specified. Hence a more expensive procedure is required, entailing a slower welding speed and a high cost per inch of weld.

When the error is not detected until most or all of the parts have been welded, the cost really does run high. Due to the use of a procedure fitted only to the welding of the *specified* steel, the welds will be cracked or porous. Seldom can the parts be used at all unless they can be salvaged by rewelding with the correct procedure. This is vastly more expensive than the first welding, for the old welds must be chipped out and the new welds made much heavier in order



1—HERE are the proper fit-up gaps for several common types of joints



2—METHODS of proper edge preparation for common types of butt joints

to assure proper joint strength. In many instances, salvage is impossible, and then material, fabrication and welding costs all go down the drain. It pays to make sure the steel is right before welding!

Good and Bad Steel

Next to material analysis, the condition of the steel is the most important consideration. Regardless of material, there are both good and bad steels. Only the best steel should be used for weldments. Steel that looks pitted, streaked or otherwise than smooth surfaced is usually porous, stratified or laminated. It is not suited for much of anything, much less for welding. Steel that looks bad should be checked and tested before welding is allowed. Bad steel is not only weak in itself but makes poor, weak and costly weldments.

It cannot be stressed too often that the surface of all steel to be used in weldments must be clean! Dirt, grease, oil, scale, rust, paint or other impurities on the surface are highly detrimental to quality welding. Surface impurities mix with the weld metal and weaken the joint; they also slow up welding.

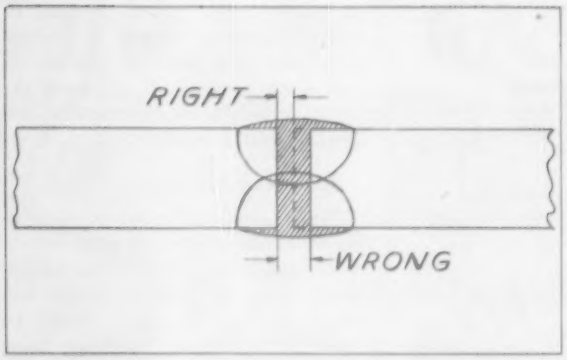
All dirty steel should be thoroughly cleaned by sandblasting or some other efficient method before it goes to the weldors. Neglect of this simple operation can mean weaker welds and greater cost.

Steels that have been galvanized, nitrided, carburized or terne-plated are equally bad offenders weldingwise. Sulphur segregations in a steel can make welding very difficult. Steel from rerolled old rails may contain a galaxy of impurities, which will make the weldor's task nearly impossible. These bad surface conditions and internal impurities must be detected, and the material prevented from getting as far as the weld shop.

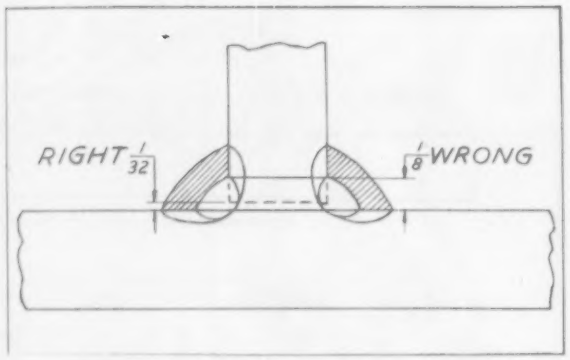
2. Dimension Control

The most important consideration after material is proper fit-up. Unless the dimensions of the parts are held within the tolerances necessary to provide the proper gaps, quality welding cannot be done at the highest possible speeds. The proper fit-up for all types of weld joints should be established by a set of standardized procedures to be used by Engineering and shop alike.* It then becomes the

*See "How design control can save you money," Welding Engineer, December, 1954.



3—RIGHT and wrong fit-up gaps for square butt joint



4—RIGHT and wrong sizes of fit-up gaps for T-joint

design engineer's responsibility to dimension the parts with tolerances that will maintain the proper fit-ups. Figure 1 shows proper gaps for most of the commonly used weld joints.

Templates, checking gages or both must be included in the plans for the inspection of every part included in a weldment. The tolerances specified on the drawing must be maintained, all standard shop practice and shop tolerances to the contrary.

All the edges or ends that join in a weldment *must be right!* The cost of their not being right is tremendously out of proportion to the cost of making them properly.

For instance, it would cost about 2.4¢ to cut off two ¼ by 3 in. bars on the shear in an average shop. The shop tolerance on this operation would probably be 1/16 in. This appears reasonable, but it is not close enough. If the parts were being butted for welding on both sides, the fit-up gap should not exceed 1/16 in. To insure the right gap, the tolerance should be plus nothing, minus 1/32 in. If the parts were made to conform to this dimension, the 6 in. of welding required on the two sides could be made in 20 seconds, 10 seconds to a side. If both parts were made the full 1/16 in. shorter that the shop tolerance would allow, the gap between them would be ⅛ in., requiring twice as much metal to fill it (Fig. 3). It would thus take 40 seconds to complete the weld on both sides.

For a fillet weld, overwelding is even more disastrous to the cost sheet (Fig. 4). Doubling the size of a fillet quadruples the amount of weld metal that must be deposited. If the fillet size is increased by only one-half, the amount of weld metal is more than doubled.

The correct and careful fabrication of parts to be welded thus plays a large part in welding cost and quality. Design must plan the parts with tolerances that will result in proper fit-up and with the correct edge preparation (see Fig. 2). Processing must plan for proper production of the parts to meet the design specifications; tooling must plan and make proper templates or design proper tools to enable the parts to be fabricated correctly in production.

If all these things are done, the actual fabrication should be almost automatically correct. Assemblies will fit properly, fit-up gaps will be correct and welding can proceed at the highest possible speed, with cost kept to a minimum. Contrariwise, any falling down on the job of correct parts fabrication will be directly reflected in much higher welding costs and lower weld quality. Therefore every effort should be made to maintain high standards in the fabrication of parts to be welded.

In most cases, achieving of the critical dimension is simply a matter of going to the next most expensive method of performing the operation concerned. It is no more difficult than securing of the correct hole positioning for bolting or riveting. Shop habits are deeply ingrained, however, and the taking of greater care, or of changing methods of cut-off or trim, is sometimes hard to get started. The results in lowered welding costs are gratifying enough to warrant the retraining of workmen to make the parts the right way. The greater cost of the properly made parts is usually less than 10% of the savings that will be effected in welding them.

3. Inspection

It is the duty of others to control the material and the dimensions of parts. It is the duty of Inspection to see that these things are done correctly and to see that parts not correct do not move a step further along the production sequence.

Besides its duty of protecting and maintaining product quality, Inspection can hold the line on welding costs to a marked degree. Costs can amount to as much as 10% more because of steel of the wrong analysis or dirty material, and up to 25% more for improperly fabricated parts leaving large fit-up gaps.

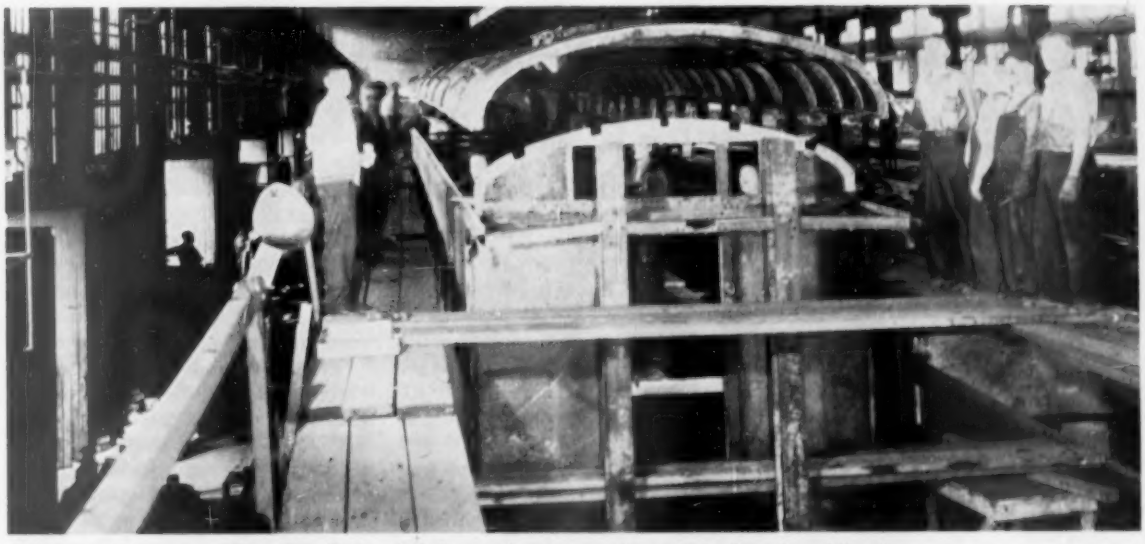
To keep welding costs down, Inspection should be delegated with the task of checking all incoming steel, by spark test or other method, to insure use of only the steel designated for the parts. Armed with drawings and specifications furnished by Engineering, Inspection should pay particular attention to overall dimensions of parts that must fit up properly for economical welding and to the preparation of edges along which a weld must be made.

No material that is not as specified should ever be allowed to reach the shear or saw for cut-off. If production is once begun, economy (false though it may be) may dictate that the parts be used even though they are wrong. Actually, it would be an economy to scrap the bad parts, in most cases.

Parts found to be too long for proper fit-up can always be cut down, and Inspection should insist that this be done. Parts too short (unless they contain much expensive material or expensive fabrication) should be rejected and scrapped, for large gaps must be filled with expensive weld metal in order to use them. If the edge preparation is not correct, it can cause faulty and expensive welds, and parts that do not conform to the drawings in this respect should be reworked or rejected.

Flame-cutting a liner . . .

Arc welding a boiler seam . . .



Joining roof to a car of Canadian National Railways. Anyway you figure it, in Canada welding is . . .

Big business on railroads

BY HUGH G. JARMAN

THE COMBINED welding forces of the Canadian National and Canadian Pacific Railways have a total of over 1,500 weldors and over 900 welding machines, scattered all the way from Halifax to Vancouver. Men and equipment are kept working overtime the year-round wherever the railways have a roundhouse or maintenance-of-way crew. The saving that welding effects runs into millions of dollars annually.

In just one scrap-reclaiming yard of the Canadian National Railway, over $50,000 a month is saved by rebuilding worn car couplings. New metal is welded on where the coupling has been worn to the replacement point. The saving is $50 on each coupling reclaimed in this manner, a cool $600,000 each year.

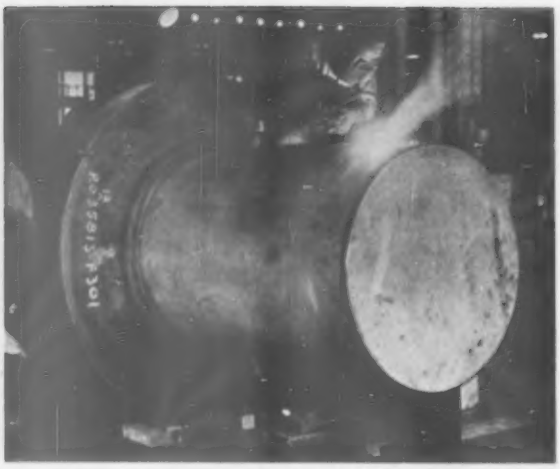
With both railroads, welding is so widespread that it is used for almost every type of work and repair. The Canadian Pacific Railway welds the steel roofs on all its passenger cars, cutting the usual time over riveting by 50% and getting a stronger roof and car wall bonding. The car roofs are welded with the aid of giant welding jigs, and the welding is done by a motorized carriage running along the seam on a track.

Submerged-arc welding is particularly well adapted to car sides. The plates making up a side can be joined

(Continued on page 44)

Courtesy The Lincoln Electric Co.

302 **Fabricating a kitchen sink of the popular 18-8 stainless. An E308-16 electrode will serve admirably for this type of material**



Courtesy Westinghouse Electric Corp.

309 **Inner hood of annealing furnace. To weld 0.078-in.-thick 309 shell to ¼-in. mild-steel base, a 309 titania-lime electrode was used**

How to arc weld the different

Practical information from a well-known contributor. This month Mr. Spencer covers the austenitic or 300 series; next month the ferritic and martensitic steels.

BY LESTER F. SPENCER

BEFORE you start in to weld any of the stainless steels and stainless irons of the AISI 300 and 400 series, you must have a thorough knowledge of the properties of these materials and their reaction under welding heat. To begin at the beginning, the stainless steels may be conveniently divided into three groups. Learn them by heart:

Group A. The austenitic stainless steels, containing both chromium and nickel.

Group B. The martensitic or straight-chromium steels, which contain little or no nickel and chromium from 11.5 to 18.0%.

Group C. The ferritic steels, having no nickel and, usually, chromium in excess of 18.0%.

The welding of the austenitic stainless steels will be discussed in the present installment, while information on the welding of the martensitic and ferritic steels will be deferred until next month.

Chromium-Nickel Steels

Group A steels, the austenitic group, contain nickel in amounts varying from 6 to 22% and chromium from 16 to 26%. These are the stainless steels of the AISI 300 series. They have excellent corrosion resistance and, in the higher alloyed materials such as types 308, 309 and 310, are noted for their excellent heat resistance. These steels are non-hardenable. Welds in them are characterized by exceptional toughness, even at low temperatures.

Stainless types 301, 302, 303 and 304 comprise the bulk of stainless that is used commercially; this subgroup is often considered as a family because of its similarity in both analysis and welding procedure. Type 301 contains 16-18% chromium, 6-8% nickel; type 302 17-19% chromium, 8-10% nickel. Both 301 and 302 have excellent corrosion resistance; however, difficulties in carbide precipitation will occur during metal-arc welding. Type 304, with 18-20% chromium, 8-11% nickel, differs from type 302 mainly in a much lower carbon content. Whereas the carbon in 302 may run as high as 0.20%, in type 304 it is limited to a maximum of 0.08%.

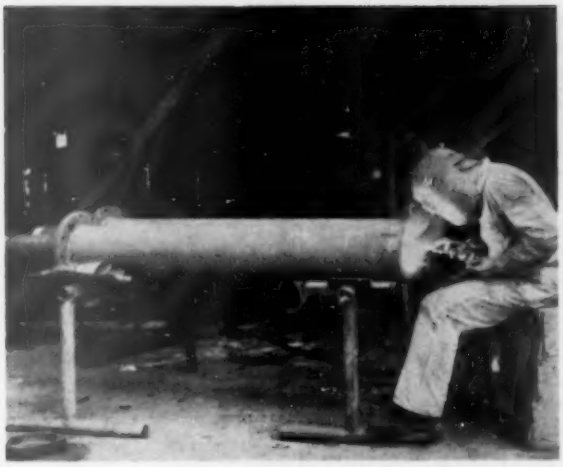
Type 303 is the standard free-machining analysis; it contains either sulphur or selenium to promote easy machinability.

The higher alloyed materials such as types 308, 309 and 310 are noted for their excellent heat resistance. These steels may contain up to 26% chromium and up to 22% nickel.

Types 316 and 317 stainless are chromium-nickel steels with molybdenum additions of 2-3% (316) and 3-4% (317). These steels are noted for their excellent corrosion resistance in certain applications, this being especially true where pit corrosion may be encountered. Type 317, with the higher molybdenum and chromium content, is the more stable alloy and is less susceptible to precipitated carbides. Type 316, due to excellent creep characteristics, has good heat resistance up to 1,650 F.

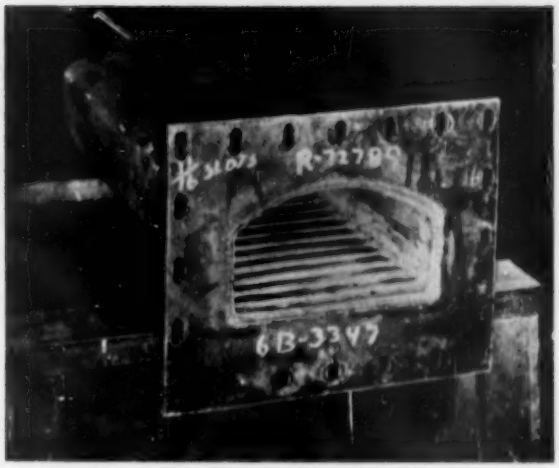
Stainless type 300, which contains the highest nickel content of any alloy in the 300 series, has both excellent corrosion resistance and good heat resistance at high temperature. It is used frequently for furnace parts such as annealing boxes, hoods and retorts.

The list of the austenitic stainless steels is completed by the two stabilized types: 321 and 347. Type 321 contains titanium to the amount of five times the carbon minimum, and type 347 columbium to the amount



Courtesy The Lincoln Electric Co.

317 **A stainless with a molybdenum addition offers advantages. Product being welded is a liner of a pulp-mill smelter blow nozzle**



Courtesy Westinghouse Electric Corp.

330 **Muffle for ammonia-atmosphere furnace is of cast 330, more frequently known as HT. A 5/32-in. E330 lime-type electrode was used**

types of stainless steels—I

of ten times the carbon minimum.

ELECTRODES FOR ARC WELDING

In the metal-arc welding of the stainless steels, protection of both weld pool and the cooling weld metal requires a heavily coated electrode. The coating fuses at welding heat and rapidly rises to the top to act as a slag layer, covering and protecting the weld from the atmosphere as it cools. In addition, the coating also provides a protective shield around the arc, helps toward arc stabilization, minimizes spatter and protects the filler metal as it flows into the weld joint.

A general policy of electrode selection is that the weld metal be of the same general analysis as the base metal. As to the characteristics of a good electrode, the following have been listed:[2]

(*a*) The electrode should have a tough, adhering coating, which will not crack nor flake and which will have a very high degree of resistance to moisture absorption;

(*b*) The coating should be of uniform thickness and concentricity;

(*c*) The electrode should display excellent performance on all welding positions;

(*d*) A smooth arc action should be realized along with an extremely low spatter loss;

(*e*) The slag characteristics should be arranged to give proper bead formation and also ease of cleaning;

(*f*) A fine, smooth bead with relatively flat contour should be deposited.

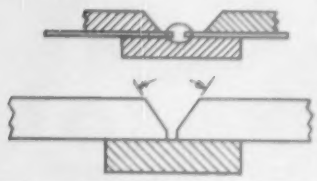
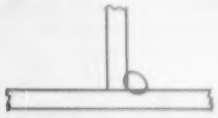
Stainless electrodes are available in two types of coatings: (1) a combination titanium-lime coating suitable with a-c and d-c reverse polarity, and (2) a straight lime coating for d-c reverse polarity welding. The lime-coated electrode usually produces less slag and is recommended[8] when the joint is highly restrained, so cracking is a definite problem, or where welding must be done in the downhill vertical position or when it is necessary to weld the free-machining composition type 303.

The titanium-lime electrode usually gives a smoother arc action, the metal flowing easily with a minimum of spatter. It permits welding with a-c, gives a smoother weld bead and a slag layer that is easily removed from the weld surface. This type of coated electrode is usually recommended when the weld bead requires cleaning and polishing. Where the conditions of welding will permit a choice of coating, the titania-lime electrode should be chosen because of its better operating characteristics.

Existing specifications such as ASTM A298-48T will assure the consumer the very best in stainless electrodes when he purchases from a reputable manufacturer. This specification covers such factors as weld-metal analysis, physical properties of all-weld metal, coating and core wire standards and methods pertaining to testing.

Those compositions known as "austenitic," which contain both nickel and chromium, have certain characteristics quite different from mild steel. For example, austenitic stainless will expand about 50% faster than mild steel, with consequent greater danger of distortion or warping. The undesirable distortion can be minimized or even eliminated by using welding jigs that will hold the joint firmly and thus combat the forces of both expansion and contraction. Tack welding can also be used to advantage [3,6] especially where the joint is relatively long. Clamping fingers and copper back-up bars also reduce the danger of warpage as well as the danger of burning through. Clamping fingers and back-up bars are even more effective if water cooled. Where these devices are employed, it is suggested[3] that clamps be retained until the weld has cooled; this practice realizes a maximum reduction of warpage.

A second factor to consider is that of heat conductivity. The heat conductivity of the austenitic stainless steels is approximately 50% less than that of mild steel. Thus heat dissipa-

Joint Type	Plate Thickness, In.	Pass No.	Electrode Diam, In.	Arc Speed		Amp	Comments
				Ipm	Fph		
Butt Weld 	0.0478	1	5/64	15	75	45	----------
	0.0747	1	3/32	12	60	60	1/32 in. gap in joint
	0.125	1	1/8	9	45	90	1/16 in. gap in joint
	0.1875	1	5/32	7	35	125	Shoulder and gap at 1/16 in.
	0.250	1	5/32	6	17.5	125	Shoulder at 3/32 in.; joint
		2*	3/16	8		160	gap at 1/16 in.
	0.375	1	5/32	6		125	Shoulder and gap at 3/32 in.;
		2	3/16	8	12	160	included angle on V joint is
		3*	3/16	8		160	60 degrees.
Lap Weld	0.0478	1	5/64	13	65	45	
	0.0747	1	3/32	13	65	65	Single pass welding up to
	0.125	1	1/8	13	65	90	and including 0.250 in.
	0.1875	1	5/32	10	50	125	
	0.250	1	3/16	6.5	32.5	160	
	0.375	1*	3/16	8	21.25	160	
		2	3/16	9		160	
Fillet Weld 	0.0478	1	5/64	9	45	45	
	0.0747	1	3/32	9	45	60	Single pass welding up to
	0.125	1	1/8	9	45	90	and including 0.250 in.
	0.1875	1	5/32	7	35	125	
	0.250	1	3/16	5.5	27.5	160	
	0.375	1*	3/16	5.5	17.5	160	
		2	3/16	8.5		160	
Corner Welds	0.0478	1	5/64	19	95	45	
	0.0747	1	3/32	15	75	60	Single pass welding up to
	0.125	1	1/8	13	65	90	and including 0.250 in.
	0.1875	1	5/32	11	55	125	
	0.250	1	3/16	7	35	160	
	0.375	1	3/16	8	17.5	160	
		2*	3/16	6		160	
Edge Weld	0.0478	1	5/64		100	45	
	0.0747	1	3/32		90	60	
	0.125	1	1/8		75	90	
	0.1875	1*	5/32		60	125	

* Very slight weave

Note: Where copper back-up bars are used, they should be grooved approximately 3/16 in. by 1/16 in.

Arc speed on the basis of welding time only with no allowances for fatigue, cleaning, setting up, etc.

Adapted from "Procedure Handbook of Arc Welding Design and Practice," Ninth Edition, 1950, The Lincoln Electric Co., Cleveland.

tion from weld to parent metal is a good deal less, resulting in a high heat concentration within the weld zone. Hence less heat is required to obtain a given penetration. As a general rule, a 10% reduction in current from mild-steel settings is required when welding the stainless austenitic steels.

Other characteristics of the austenitic stainless steels also demand the use of a lower current. The electrical resistance of these materials is about six times that of mild steel (this value may increase to twice that amount when the alloy has been extremely cold worked). Another reason for the use of a reduced current is that stainless electrodes will melt off at a considerably higher rate than mild-steel electrodes so that more metal is deposited for a given current setting.

Carbide Precipitation

Among disadvantages in the welding of the austenitic stainless steels is the well known and objectionable phenomenon of "carbide precipitation." Intergranular carbides tend to form during welding in the "unstabilized" stainless steels. This carbide precipitation is harmful since it substantially reduces the corrosion resistance of the material. Let's look at it more closely.

Upon the application of the welding arc, there will be a thermal gradient between the actual deposit area and the non-heat-affected metal. Somewhere in the heat-affected zone a temperature of 800-1,500 F will be realized. This area is susceptible to the formation of carbides, and the temperature range between 800 and 1,500 F is referred to as the "danger zone." The speed at which carbides will form will vary with a number of factors[6]:

The longer the time during which the material is held within the danger zone, the more carbides will be precipitated.

The closer the actual temperature is to 1,200 F, the more harmful the precipitate.

The chromium-nickel steels with the higher carbon content are more

susceptible to the formation of the harmful carbides when compared to base compositions with lower carbon contents.

The greater the total of the percentages of nickel and chromium in proportion to the percentage of carbon in the base metal, the less rapid will be the formation of these carbides.

The above facts would suggest remedies in which the formation of carbides can be minimized. Light-gage welding holds carbide precipitation to a minimum by permitting rapid cooling so that the time lag in the danger zone is minimized. A type 304 stainless or the comparatively new ELC (extra-low-carbon) stainless lowers the percentage of carbon and hence the power to form carbides.

A sure method of eliminating carbide formation is the use of the so-called "stabilized" grades of stainless. Types 347 and 321, the stabilized steels, contain, respectively, columbium and titanium. These elements unite with the carbon to form harmless carbides that do not affect the corrosion resistance.

A third method of eliminating objectionable carbide formations is to anneal the unstabilized stainless directly after welding.

Stabilized stainless steels are normally welded with stabilized electrodes. The unstabilized stainless grades are normally welded with unstabilized electrodes. It is not usually beneficial (although not harmful except from the standpoint of cost) to weld an unstabilized composition with a stabilized electrode.

Welding Procedures

In the welding of the austenitic stainless steels, the general procedure will be very similar to that employed in mild-steel welding. It is very important to prepare and fit the work carefully and to clamp the work to hold in alignment. This latter recommendation is particularly true in the welding of the light gages of stock. A clean joint area is demanded since any foreign organic matter may cause weld porosity and reduce corrosion resistance.

For welds in plate $\frac{3}{8}$ in. thick, the electrode size should be 3/16 in. Where electrode diameter is above $\frac{1}{4}$ in., there is a danger of undue loss of chromium. Rapid welding and maintenance of a short arc will reduce the chromium loss. The nickel loss is not so important since very little nickel is lost during welding.

Although slight weaving may be permissible, especially in multipass welding procedure, excessive weaving in any size should be avoided. In general, a weld made with a number of straight beads is recommended.[3] In multipass welding procedure, slag must be thoroughly removed between passes.

Welding defects such as porosity near the surface, undercutting or slag inclusions should not be tolerated because of the localized corrosion that may occur. Even small imperfections or a stress concentration near the surface may serve as a focal point for corrosive attack. Many defects that could be ignored in mild-steel welding will prove detrimental in the welding of the chromium-nickel materials. When removing the slag cover, care must be taken not to damage the metal adjacent to the weld. To prevent any iron pick-up, stainless-steel brushes should be used for cleaning. Any pinhole porosity, which may have been caused by excessive moisture in the electrode coating, can be readily remedied[3] by baking the electrodes at approximately 350 F for about an hour.

A slight discoloration may be noted on each side of the weld. This is not usually harmful and is often considered as a surface condition that can be easily removed by either pickling or by a combination of grinding and polishing. Since the electrical resistance of the stainless is so high, it is advisable to use short electrodes to avoid overheating of the electrode.

With stainless types 301, 302, 303 and 304, the only remedy for complete freedom from carbides is to anneal after welding has been completed. The annealing procedure would comprise heating the weldment to a temperature of 1,850-1,950 F and after a suitable soak quenching it in either water or air, the water quench being used for heavy sections.

Where annealing is not practicable and the additional expense of using a stabilized steel cannot be justified, a low-carbon analysis such as type 304 is frequently employed. In type 304, the carbon content is 0.08% maximum.

The sulphur or selenium, which promote the free machinability of type 303, often cause porous welds. If welding is a major factor in the assembly, the easy machinability might be sacrificed in order to secure a better welded joint. If type 303 must be used and welded, the E308-16 electrode is suggested[3]. Because of the low penetration possible with this electrode, there is less mixture with the base metal, which reduces porosity to a minimum.

Electrode Classifications

Electrodes used to weld the various grades of stainless steels are defined by the *AWS-ASTM Specifications for Corrosion-Resisting Chromium and Chromium-Nickel Electrodes.* These electrodes are classified into seven compositions: E308, E309, E310, E316, E317, E-330 and E347. These seven series of electrodes will serve for welding all the principal grades of stainless steel in the 300 series; however, other types are available.[7]

The electrode number is completed by a usability designation: —15, —16, —25 and —26. The —15 designation means a lime-coated electrode; the —16, —25 and —26 designations are reserved for titania-coated electrodes.[7]

In the welding of the other stainless-steels within the early 300 series, the E308-16 electrode will also serve satisfactorily. The quiet arc action and smooth flowing characteristics of this electrode make it especially suitable for light-gage welding. The stabilized electrode E347-16 can also be used; however, the addition of columbium adds to the expense and is of little value in welding an unstabilized stainless. In the welding of stainless type 302B, which has from 2.0 to 3.0% silicon, a special electrode can be obtained to yield a weld metal similar to the base plate composition. In most instances, the E309 electrode is used.

Direct current is usually the most satisfactory for the welding of the austenitic stainless steels; however, satisfactory welds can be made with a-c when the electrode has proper characteristics for maintaining a steady arc with minimum of spatter. High-quality welds can be produced in all positions, but porosity is difficult to eliminate completely[6] in any but the downhand positions.

Procedures for the welding of types 305 and 308 stainless steels are very similar to those used for the type 302 family group. An E308 electrode is normally employed. The high

chromium to nickel ratio (2 to 1) of the 305 and 308 steels can cause cracking to be encountered. Increase of welding speed may eliminate this.

Alloy 309 has excellent heat resistance and is used quite frequently in furnace applications. It contains 22-24% chromium, 12-15% nickel. A type 309 titania-lime coated a-c/d-c electrode is used to weld it. The weld deposit has a high resistance to oxidation and exhibits good creep values at elevated temperatures.

To weld type 310 stainless, the E310-15 electrode type is usually employed. Strong, ductile welds are produced; the best results being obtained if the area to be welded is preheated[2] between 300 and 500 F.

Each of types 316 and 317 stainless alloys has its own electrodes which will deposit an analysis similar to that of the base metal. Since the stabilized electrode, E347, does no harm, and since it is often requested, this electrode can be used.

To weld both of the stabilized compositions, types 321 and 347, which contain titanium and columbium respectively, the E347 stabilized electrode is used. This means that columbium is used exclusively as the stabilizing element in the electrode. Titanium, if present in the electrode, would be lost through oxidation in transfer across the arc during welding. The stabilized stainless compositions are used frequently where service temperatures are within the danger zone of 800-1,500 F. The use of stabilized plate and electrode will enable the structure to be used in the as-welded condition.

The type 330 alloy contains 35% nickel, 15% chromium. It is more frequently found in the cast form, designated HT, than the wrought type 330. Electrode types E330-15 and E330-16 are used to weld this analysis; a preheat of 300 F minimum is often recommended[2] for the welding of heavy sections.

For further information on the weldability of the different types of stainless steels, consult the Engineering Data Sheet on page 47.

References

[1]"ASTM Specification A298-48T," ASTM Standards, 1952, Pt. 1, pp 1134-1147, American Society for Testing Materials, Philadelphia.

[2]"Westinghouse Arc Welding Equipment and Electrodes," Cat. 26-029, Westinghouse Electric Corp., Pittsburgh.

[3]"Procedure Handbook of Arc Welding Design and Practice," ninth edition, 1950, The Lincoln Electric Co., Cleveland.

[4]"Welding Stainless Steel," 1943 edition, Allegheny-Ludlum Steel Corp., Brackenridge, Pa.

[5]"Welding Stainless Steel," L. F. Spencer, *Iron Age*, Oct. 20, 1949.

[6]"Stainless Welding Electrodes," Page Steel & Wire Div., American Chain & Cable Co., Inc., Monessen, Pa.

[7]"Welding Handbook," third edition, 1950, American Welding Society, New York City.

[8]"Welding & Metallurgical Aspects of Stainless Steels," W. G. Blackwell, General Electric Co., Schenectady.

BIG BUSINESS—RAILROADS

(Continued from page 39)

together at a rate of 60 ipm with only one pass. Another big user of submerged-arc equipment is found in western Canada, where the shops of both railroads are making fuel tanks for oil-burning Diesels.

Though railroads are traditionally slow to try out new processes, the two Canadian railroads are both big users of the inert-gas welding processes. Aluminum, stainless steel, Monel and Inconel are all being joined by some form of inert-gas welding.

According to one railway engineer, practically the only riveting that is being done today by the two railways is on boilers and safety devices. Even this is rapidly being eliminated with increasing use of Diesel locomotives.

The advent of the Diesel has, of course, eliminated some welding jobs. A lot of welding, for instance, used to go into the fireboxes and tubes on steam locomotives. On larger trains, however, Diesel haul has increased the amount of welding that is required for rolling stock maintenance, so the net gain is welding's.

In addition to jobs already cited, thousands of miles of track are being constantly welded where needed, battered rails are being built up, snow-fighting equipment is kept in proper shape to fight the winters.

In the opinion of railway engineers the writer has questioned, if welding were to be taken away from railroads their servicing and maintenance methods would be put back a hundred years. These engineers say it would be an impossibility to operate under today's high costs without the time- and labor-savings made possible by welding.

Yes, welding is Big Business in Canada today.

WELDED TUNNEL SHIELD

(Continued from page 25)

in pressure, allowing water to burst into the tunnel.

Strange things can happen in a tunnel, and the very strangest so far is what happened to Marshall Mabey when he was hogging the IRT tubes under the East River in 1916.

Mabey was digging up forward when he noticed a weak looking spot in the mud above. These are treacherous and feared by all diggers. When a hole shows up in the mud wall, the compressed air blows out and rises into the water above. This is called a blowout.

As fate would have it, Sand Hog Mabey was caught in the updraft of the most feared hazard of tunnel construction. He was bodily sucked up into the mud. His horrified fellow sand hogs saw his head go into the mud and disappear. Then his legs, then shoes were all that was visible, then nothing—he was gone!

When next seen, Mabey had been completely pushed up into the swirling water above. The pressure of the leaking compressed air tossed him high in the air before he finally sank into a fountain of agitated muddy water. He was rescued by river boatmen and suffered no more serious mishap from his terrifying adventure than a broken leg.

Two other men who were caught in the same catastrophe were not so lucky—both died. One caught in the mud, the other banged his head against a river barge. Such is no longer the life of a sand hog. Careful engineering and alertness prevented any blowouts during the construction of the first two Lincoln Tunnel tubes, and we hope that the new welded shield will bring the third-tube crew equally good luck.

Nippes continues research program for Air Force

Dr. Ernest F. Nippes, head of welding research at Rensselaer Polytechnic Institute, Troy, N.Y., has been authorized by the Wright Air Development Center (near Dayton, Ohio) to continue until next September a program of research he undertook for the Center in July, 1952. Dr. Nippes and his associates are making studies and experimental investigations into the flash welding of alloy steels.

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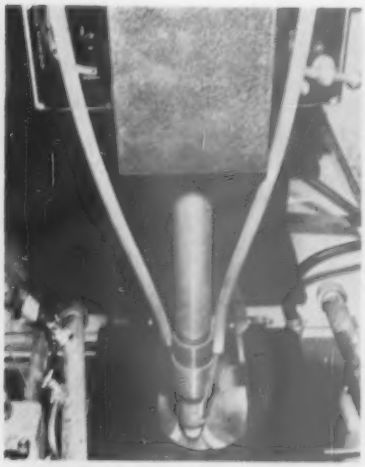
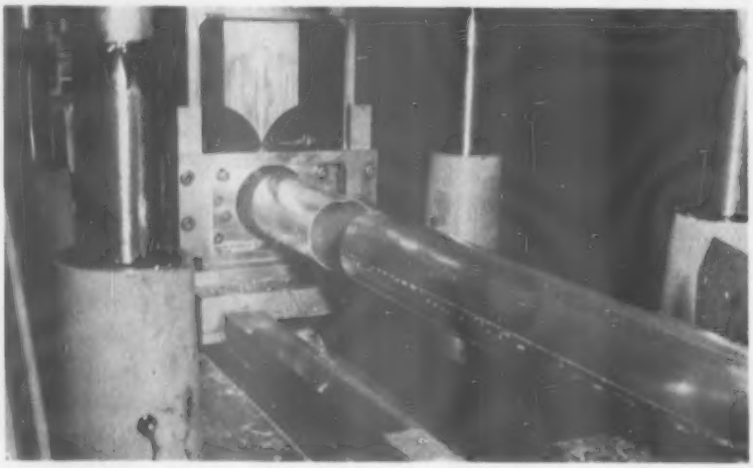


1—Tig welding head. Seam to be welded may be seen under the rolls

2—VIEW of tube mill shows how automatic head fits into the process. Not shown: plugs are inserted within tubing to confine helium during welding

3—WELDED tubing enters the hydraulically operated die cut-off



4—JUST after cut-off. Slight indentation on the end of the tube will be expanded and straightened as tube passes through the testing station

Tubes Tig welded automatically

BY LEONARD AKERS
Technical Representative, Air Reduction Pacific Co.

TYPICAL of the growing trend toward automation is the tube welding at Westube Co., Inc., Oakland, Calif. One of the first companies to develop successful automatic Tig (tungsten inert-gas) welding procedures for tubing, Westube gets complete penetration without burn-through at speeds ranging from 12 to 65 feet per minute. The tubing, most of it 3 in. in diameter, must be able to withstand a hydrostatic test pressure of 350 psi.

The automatic head for Tig welding is shown in photo 1. The welding is done without filler wire. Photo 2 shows the automatic equipment in operation. Speed of the tubing (as it moves under the welding head) is in perfect balance with current input. In photo 3, a welded tube is traveling through the hydraulic die cut-off, and tubing immediately after die cut-off is shown in photo 4.

Helium is used both on top and underneath the weld area. Plugs of nylon rubber are inserted at each end of the tube to keep the gas well concentrated inside the tube while welding is going on.

Flows range from 15 to 30 liters per minute. The welding speed regulates the flow of gas. Westube Co. can use the hotter arc obtained with helium because the arc is well controlled and is moved rapidly along the work.

In this fully automatic operation, the welding current is provided by two 400-amp d-c rectifier welders in parallel. This arrangement allows for a continuous duty cycle. Current values range from 250 to 425 amperes.

Electrodes are thoriated tungsten, 3/32 in. and ⅛ in. in diameter.

WROUGHT STAINLESS-STEEL FORMS AND WELDABILITY

		Available Forms					Weldability			Outstanding Characteristics
		Plate	Sheet	Strip	Bar	Wire	Arc	Gas	Resistance	
AUSTENITIC	301	X	X	X	X	X	B	B	A	General utility stainless; good working qualities.
	302	X	X	X	X	X	A	X	A	Readily fabricated.
	308	X	X	X	X	X	A	X	A	Used where better corrosion resistance than 18-8 is needed.
	309	X	X	X	X	X	B	X	A	High strength and high scaling resistance at high temperatures.
	310	X	X	X	X	X	A	X	A	Higher nickel content for greater stability at welding temperatures.
	316	X	X	X	X	X	A	B	A	Superior resistance to chemical corrosion.
	317	X	X	X	X	X	A	B	A	Higher alloy content than 316 for better corrosion resistance.
	321	X	X	X	X	X	A	B	A	Titanium-stabilized to prevent carbide precipitation when heated.
	347	X	X	X	X	X	A	B	A	Columbium-stabilized to prevent carbide precipitation.
MARTENSITIC	403	X	X	–	X	X	B	B	B	Low chromium content.
	410	X	X	X	X	X	B	X	B	General-purpose, heat-treatable stainless. Low cost.
	414	X	X	X	X	X	B	X	B	Nickel added for toughness.
	416	–	–	–	X	X	N.A.	X	N.A.	Free-machining, 12% chromium.
	420	–	X	–	X	X	B	X	B	Carbon provides hardness.
	431	X	X	X	X	X	B	B	B	High mechanical properties.
	440A	–	–	–	X	X	No	X	N.A.	Highest hardness of all stainless steels.
	440B	–	–	–	X	X	No	X	N.A.	Best combination of properties of 440 grades.
	440C	–	–	–	X	X	No	X	N.A.	Least tough of 440 grades but highest abrasion resistance.
	501	X	X	X	X	X	B	X	B	Corrosion resistance rather than stainless; good strength at high temperatures.
	502	X	X	X	X	X	B	X	B	
FERRITIC	405	X	X	X	X	X	B	X	B	Non-hardening when air cooled from high temperatures.
	406	–	–	–	X	X	B	X	B	For electrical resistance. Resists high-temperature oxidation.
	430	X	X	X	X	X	B	X	B	An easily formed stainless. Low cost.
	430F	–	–	–	X	X	B	X	B	Free-machining variety 430 grade.
	446	X	X	X	X	X	B	X	B	Best scaling resistance and highest chromium content.

A – readily weldable. B – weldable under favorable conditions. X – weldable by gas process in 20 ga. or thinner
N.A. – No welding information available.

on the job . . .

EXACT angles are turned out with inexpensive weld-and-check fixture

Railroad car repair

THE Pullman Co. has found that spot welding can be used advantageously in the maintenance of its stainless-steel passenger cars. Damaged cars may be repaired quickly with equipment like the electronically controlled gun welder pictured above. The operator is Clarence A. Bearden, of the Pullman Company's Richmond, Calif., shops.

One time-saving feature of stainless-steel construction is that it automatically eliminates the necessity of removing the finish and subsequent refinishing when repairing a car. Another time saver is the weldability of this material.

* * *

Angle jig

ANGLES for aircraft jigs are formed quickly and precisely on a weld-and-check fixture developed at Temco Aircraft Corp., Dallas, Tex. Weldors estimate the fixture saves an average of five manhours per jig by simplifying the positioning and welding of open and closed angles and gussets.

At the Dallas, Tex., plant, where tooling is underway for production of B-52 fuselage sections, as many as 2,000 angles are used in a single jig. Sides of these angles range up to 22 in. long—almost twice the length of the largest standard stock angle. Hence many of the angles have to be fabricated.

Weldors formerly held angle sides together by hand while they tacked them with the arc. Considerable adjusting and checking with a square was necessary before even a 90-deg angle was accurate enough for a final weld and machining. If a welded angle turned out to be inaccurate by 4 deg or more, machining usually removed more material than the thickness minimums allowable. Even slight inaccuracy in the joining together of angle sides caused excessive machining time.

Temco Jig Builder Woodrow W. Keas designed the weld-and-check fixture for angles; then built it in less than four hours. The fixture has a back plate and a bed plate, each made of 10 by 10 in. pieces of 1-in. steel plate. Welded to the bed plate to serve as feet are four 3 by 3 by 2½ in. angles.

Face plate and bed plate are hinged together by two hinges, which are welded to the bed plate and are joined to the back plate by two dowels. The hinging allows the angle formed by the back and bed plates to be opened and closed.

Closure is regulated by a ½-in. threaded bolt 13 in. long. This bolt runs horizontally through a block welded to the bottom of the bed plate and through a swivel block, which is secured by dowels to the bottom edge of the back plate. Two star nuts are attached to the front end of the bolt. The fixture operator turns one nut to tilt the back plate to form any angle from 30 to 180 deg. He turns the other to lock the back plate at the desired angle.

It takes less than a minute to set up the fixture, and tacking of the angle is almost as simple. One angle side is placed horizontally on the bed plate. The other is placed upright, flush against the back plate. Both sides are secured to their respective plates with C-clamps.

The angle is established by turning the star nut until an indicator, on one edge of the back plate, is opposite the desired degree mark on a protractor. The fixture is locked with the other star nut, the gusset is placed in position and tacked, and the angle sides are tacked together. Then C-clamps are loosened, and the angle is removed for final gas or arc weld.

These angles are true to within one degree when they are ready for machining. The jig has thus reduced machine time an average of 10 minutes to a unit.

* * *

Hardfaced hammers

HARDFACING has tripled the life of coal-crusher hammers at Connecticut Coke Co., New Haven, Conn. The hammers are used in a machine that crushes 1,600 tons of bituminous coal per day. Unprotected hammers in this machine give about three weeks' service. Hammers hardfaced with a cobalt-chromium tungsten alloy give 9 to 10 weeks of service.

Each of the 270 hammers in the machine is hardfaced. The hammers are on the periphery of a drum, which revolves at 720 rpm and is driven by a 400-hp motor. Coal falls from a hopper on top of a perforated plate and under the crusher drum. The hammers on the rotating drum force the coal through the perforated plate. After passing through this crusher about 85% of the coal is screened through ⅛-in. mesh.

The hammers are 13½ in. long, 4 in. wide, 1½ in. thick and are made of high-carbon manganese steel. They are hardfaced on one end and two sides to a length of about 1½ in. About 1/3 to ½ lb of rod is used per hammer.

Data courtesy Haynes Stellite Co.

THE TOUGHEST, MOST FLEXIBLE WELDING CABLE you've ever used!

Ask any welder who uses Carol Dynapower Welding Cable. He'll tell you it's so pliable that he can bend it, coil it, and twist it wherever he wants . . . with so little effort that he makes top quality welds with minimum fatigue. The reason: Carol's special rope lay stranding that combines thousands of soft, fine wires into a flexible cable. It's plenty tough, too. Its abrasion-proof jacket of Carol rubber stands the roughest handling, and resists acids, solvents, water and oil. Available in sizes from 4/0 to No. 6 gage in rubber and Neoprene jackets.

. . . made better . . . to perform better

Like all Carol wire and cable, Dynapower Arc Welding Cable is manufactured under strict laboratory control in our complete wire-making plant. Every step, from drawing of wire to compounding of insulation, is centralized under our single responsibility. Write today for complete information to Dept. WE or see your nearby Carol distributor.

A SUBSIDIARY OF Penn-Texas

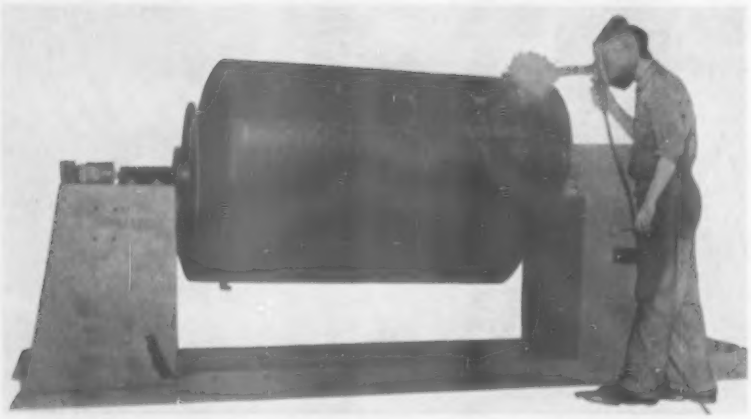
Carol CABLE COMPANY

DIVISION OF THE CRESCENT CO., INC., PAWTUCKET, RHODE ISLAND

Serving Industry for more than 30 years

new products . . . . . USE CARD ON PAGE 95

ONE of models is lift-front type



WELDMENTS from 500 lb to 50 tons can be handled by this new apparatus

Plastic headshields

TWO new molded fiber-glass plastic headshields for weldors are reported to offer the user lighter weight comfort with complete head protection from the welding arc and spatter.

"Type 971" has the lens holder molded right into the shield to eliminate light leaks and to further reduce the weight. "Type 973" is of the same general design and plastic construction, except it has a lift-front lens holder to permit the operator to view, chip and clean the weld without raising the hood. *Hobart Bros. Co.*

Circle No. 50.

* * *

Flux

FLUXING action of 100% is said to be provided by a new flux that does not contain any grease or binding material and eliminates steel wool cleaning of joints to be soldered. Called "C-Flux," it also tins the metal as it cleans, permitting solder to flow smoothly with deep penetration, it is claimed. Available in 3-oz and 1-lb cans. *American Solder and Flux Co.*

Circle No. 51.

* * *

Electrode

NON-heat-treatable electrode is for welding highest alloy steels. Deposits can be work hardened to over 180,000 psi tensile strength and maintain their very high strength at elevated temperatures. They are characterized by high corrosion-resistance, hardness, and wear-resistance, it is claimed.

This new electrode is an alloy of chromium and nickel and is applicable with a-c and d-c welders. Its as-welded properties include: tensile strength, 120,000 psi; elongation in 2-in. 25%; hardness, 200 Brinell. Designated "All-State No. 275," it is available in 3/32, 1/8, 5/32 and 3/16-in. core sizes. Standard packages are 5 lb. *All-State Welding Alloys Co., Inc.*

Circle No. 52.

* * *

Acetylene generator

PORTABLE acetylene gas generator is said to be explosion-proof. Special design prevents water from flooding carbide hopper even when upside down, while charged and in operation. Generator also features newly designed gravity feeding unit. This portable, one-man unit is made in three sizes of about 5-cu-ft, 12½-cu-ft and 25-cu-ft gas capacities, weighing 30, 50 and 80 lb, respectively.

Units are used for soldering, brazing and heating. With addition of oxygen, they make complete welding and cutting rigs. *Port-O-Matic, Inc.*

Circle No. 53.

Welding lathe

LATHE for welding is made in weight capacities from 500 lb to 50 tons. The head and tail stock are both mounted on a track, with the tail stock adjusting for work lengths desired. The tail stock has a hydraulic power ram revolving with the head. The pressure exerted on the ram section is so made that it is controlled automatically.

Variations in this "UWL" series can be made to suit applications. *Unique Turntable & Equipment Corp.*

Circle No. 54.

* * *

Resistance welders

THREE-phase "SPT 1" and "EPT 1" spot and projection welders are standard, air operated, press-type machines available in 40, 50 and 75 kva at 50% duty cycle. The "SPT 1" can be supplied in throat depths from 18 in. to 42 in., with an electrode force of 1,000 to 1,575 lb (80 psi), dependent on throat depth. The "EPT 1" can be supplied from 12-in. to 30-in. throat depth, with an electrode force of 1,000 lb to 1,575 lb, dependent on throat depth. *Sciaky Bros., Inc.*

Circle No. 55.

* * *

Helmet sweat bands

MADE from genuine hatter's leather and padded with felt for extra comfort, these sweat bands for welding helmets are easily attached with conventional glove fasteners, it is claimed. Available in two widths: ⅞ and 1¼ in. *Sellstrom Mfg. Co.*

Circle No. 56.

(More new products on page 57)

NEW and unbelievably FAST

RACO

624 CONTACT ELECTRODES

Approved by American Bureau of Shipping as E-6012 modified

Users report 4 outstanding advantages—

1. FASTER . . . 3/16" electrode 43% faster deposition than a 1/4" E-6020
2. SOUNDER WELD METAL . . . Superior X-ray quality
3. HIGHER IMPACT VALUES . . . 20-30 ft. lbs. at —40° F.
4. EASIER SLAG REMOVAL . . . Practically self-removing

For greater production, order these time and labor-saving electrodes today. "See our distributor" or—write us direct for samples and complete technical information

DISTRIBUTORS FROM COAST TO COAST

The REID-AVERY COMPANY Inc.

BALTIMORE 22, MARYLAND

SINCE 1919 PRODUCERS OF ARC-WELDING ELECTRODES AND WELDING RODS

These rolls, hard-faced when new with Coated Tube Stoodite, have been in operation 3 months, crushing extremely hard river rock. When hard-facing is re-applied beads are slightly separated, areas between being filled on successive applications.

IMPROVING CRUSHER EFFICIENCY with Stoody Hard-Facing

All crusher rolls lose sizing efficiency because of uneven wear. As roll centers become worn, a gap develops between them, permitting oversize material to pass through. With continued wear, crusher adjustments cannot compensate and efficiency is lost.

BALANCING WEAR RESISTANCE

The answer is use of two Stoody Hard-Facing Alloys of dissimilar wear resistance. Roll centers are protected with Coated Tube Stoodite; outside areas with Stoody 21. *This procedure concentrates extra wear resistance where most needed, at the same time saves money by using a lower cost alloy on edges!* Net result is balanced wear, flatter roll surfaces and more uniform sizing of material over life of the rolls.

HARD-FACING KINKS

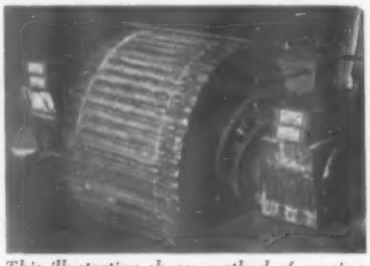
Always skip-weld to avoid overheating. New hard-facing beads can be applied alternately between former deposits.

After repeated welding, manganese rolls may deteriorate from application of heat, causing hard metal to spall. This can be prevented by applying a layer of Stoody Nickel or Moly-Manganese to the parent metal after 3 or 4 hard-facing applications. If crusher rolls are carbon steel, use Stoody Build-Up.

IMPROVING GRIP

A better grip is possible if one roll is hard-faced with a series of spaced stringers, forming corrugations. Follow the same bi-metal technique for balancing wear.

By repeating hard-metal applications, as required, three times normal life is not unusual for crusher rolls. This and other crusher hard-facing techniques are described in the Stoody Hard-Facing Guidebook.



This illustration shows method of spacing stringer beads on one roll to improve grip. Coated Tube Stoodite is applied in center area, Stoody 21 on outer edges.

Ask your Stoody dealer for a copy (See the yellow pages of your phone book) or write direct!

STOODY COMPANY

The Best Welding costs less when you use

MALLORY

Standard Electrodes

BEFORE YOU GO to the expense of ordering a special resistance welding electrode . . . or making up your own . . . take a look at the extensive selection of Mallory standard types and sizes. You will probably find exactly the electrode that your particular application requires. Many of these types are available immediately from Mallory stock, at a cost substantially less than that of special design.

The more than two hundred standard Mallory electrodes include a choice of many different tips . . . with round cooling hole or with the exclusive Mallory fluted hole that provides greatly improved electrode life at no extra cost. You can select from varied single-bent and double-bent designs, all cold-formed from standard straight tips to retain maximum hardness and strength . . . with fluted holes and bent-in-place cooling tubes.*

Your operating costs, too, are reduced by the long, efficient performance you get with Mallory electrodes. Precision-made from special Mallory alloys, they result from more than 25 years of research and development in the resistance welding field.

For expert assistance in electrode selection, see your nearby Mallory distributor, or write direct to Mallory. And for technical data on all standard and special electrodes and other welding materials, write for a copy of the latest Mallory Resistance Welding Catalog.

*Patent No. 2,489,993

Expect More...
Get More from
P.R. MALLORY
MALLORY

In Canada, made and sold by Johnson Matthey and Mallory, Ltd., 110 Industry Street, Toronto 15, Ontario

P.R. MALLORY & CO. Inc.
MALLORY
P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

STOCK ELECTRODES

Hundreds of shapes and sizes are available in stock . . . with round water holes or the exclusive Mallory fluted cooling hole for longer life between dressings. Save you both cost and delivery time.

ELECTRODE HOLDERS

The Mallory family of electrode holders covers pressures from under 100 to over 6000 pounds . . . straight, offset, paddle-type and universal models.

For information on titanium developments, contact Mallory-Sharon Titanium Corp., Niles, Ohio

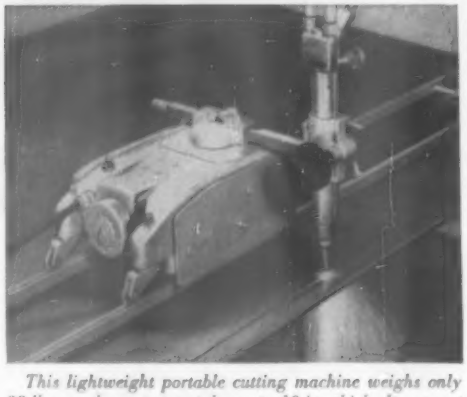
Machine-Cutting Clears the Way to $13,000 Savings

One steel company is saving up to $13,000 a year by using oxygen shape-cutting machines for making ingot and pan links from steel plate.

Previously these parts were forged at an annual cost of approximately $30,000. The speed and accuracy of oxygen shape-cutting cut costs to $17,000 a year—a savings of more than two dollars on each of the 5,000 parts made.

Machine-cutting setups are speeding fabrication and cutting costs throughout industry. Whatever your part-producing needs are—cutting hundreds of parts at one time, or one-of-a-kind turnout—there are LINDE oxygen shape-cutting machines to help you save hours and dollars in production time.

LINDE service engineers will be glad to help you determine the shape-cutting setup to best serve your job needs. Call your local LINDE representative for more information. Start saving now—call him today.



This lightweight portable cutting machine weighs only 38-lbs., and can cut metals up to 10-in. thick. It can cut straight lines, circles, and plate edge preparations in from 4-in. to 32-in. per minute.

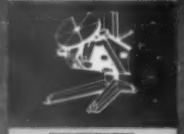
Linde Air Products Company
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
Offices in Other Principal Cities
In Canada: DOMINION OXYGEN COMPANY
Division of Union Carbide Canada Limited, Toronto

Linde Trade-Mark

"Heliarc," "Unionmelt," and "Linde" are registered trade-marks of Union Carbide and Carbon Corporation.

America's most complete line of arc-welding equipment and electrodes.

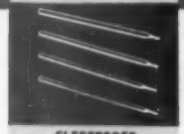
AC WELDERS
Sizes up to 625 amps. All connectable to 220 or 440 volts—550 volts on request.



POSITIONERS
Capacities from 2500 to 35,000 lbs. — remote-control and hand-operated models.

AC/DC WELDER
The only machine to give you either AC or DC current at the flip of a switch.

DC RECTIFIER WELDER
Four sizes—200, 300, 400, and 500 amps.



ELECTRODES
For mild steel, cast iron, "hard-to-weld" steels, stainless steels, hard surfacing.

P&H DC Welders in shed at Kane Ship Repair Co. Kane also houses their P&H AC machines this way.

a full year's operation -and not one minute's downtime

. . . that's the record racked up by 100 P&H Arc Welders in a Brooklyn ship-repair yard.

Ask the Kane Ship Repair Company of Brooklyn about P&H reliability and get a real story. After a full year's operation with an even 100 P&H Arc Welders, it has yet to spend the first nickel for repairs — or experience a minute's downtime. It means Kane has eliminated the usual costly practice of having an extra stand-by machine for every four welders for use when something goes wrong.

What's even better is the saving of $120,247 on just *one* ship conversion job. That's what the cost accountant says Kane saved by replacing its old-fashioned engine-driven welders with modern P&H equipment.

You too, can eliminate maintenance problems when you switch over to P&H. These welders have no moving parts — no moving coils or hard-to-work cranks. There's nothing that can bind or freeze. With P&H Dialectric Control the welder simply turns a large radio-type dial (or steps on a foot treadle) and he has instantaneous, stepless heat control over the entire range.

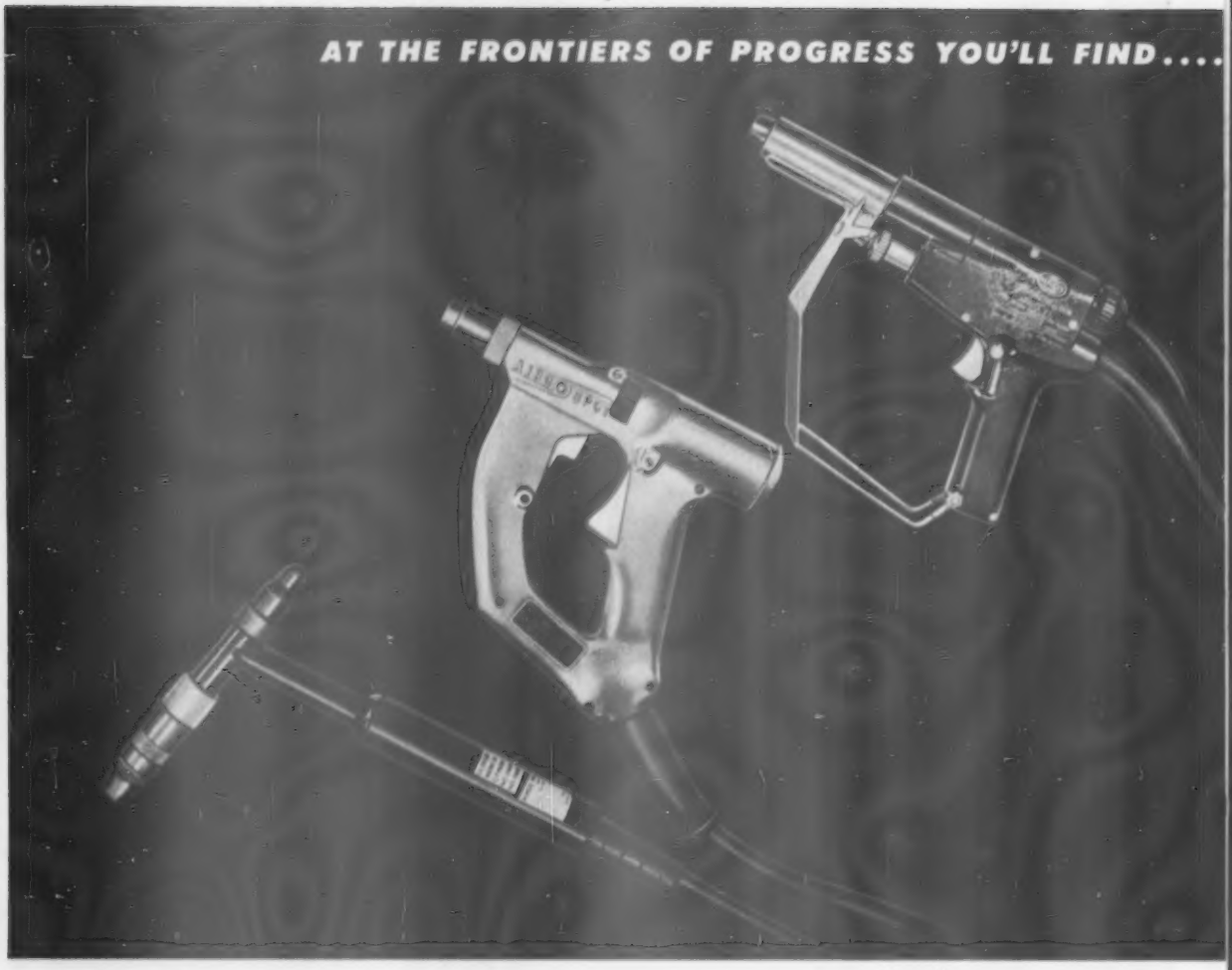
There's more — much more — to tell about P&H Arc Welders . . . and how they can mean significant savings for you. We'd like to give you full details. Call your P&H representative or distributor or write us now.

P&H WELDING DIVISION
HARNISCHFEGER CORPORATION
4513 W. NATIONAL AVE. • MILWAUKEE 46, WISCONSIN

the P&H *Line*

TRUCK CRANES · DIESEL ENGINES · POWER SHOVELS · PREFABRICATED HOMES · HOISTS · SOIL STABILIZERS · WELDING EQUIPMENT · OVERHEAD CRANES

P&H welding equipment is manufactured and sold in Canada by REGENT EQUIPMENT MANUFACTURING COMPANY LTD., 455 King Street West • Toronto, Ontario, Canada



Get Airco Inert-Gas Welding into your Production Picture!

Lower costs through quality and speed . . . that's Airco's answer to your production problem – even when the materials include aluminum, bronze, copper, nickel, stainless steel . . . all engineering metals.

The Aircomatic welding unit, for example, was researched and designed by Airco to produce top-quality welds . . . especially in "problem" metals and alloys without flux . . . with minimum plate edge preparation and little or no preheat. In performance, Airco's Heliwelding is similar – though engineered for high-speed welding of *thin* sections of metals – any metals.

And with the newest Airco addition to inert-gas-shielded welding, Aircospot, you can weld from one side of the joint – eliminating jigs and backup plates. Aircospot is the perfect primary tool for fabrication and no finer cost-saving tool for tack welding has ever been devised.

You'll want to learn more about how Air Reduction's inert-gas-shielded arc welding processes can serve you. Contact your nearby Airco Representative, Authorized Airco Dealer – or write Airco direct.

AIRCO®

AIR REDUCTION

60 East 42nd Street • New York 17, N. Y.

Divisions of Air Reduction Company, Incorporated, with offices and dealers in most principal cities

Air Reduction Sales Company
Air Reduction Pacific Company

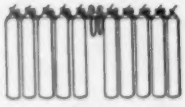
Represented internationally by Airco Company International

Foreign Subsidiaries:
Air Reduction Canada Limited,
Cuban Air Products Corporation

Products of the divisions of Air Reduction Company, Incorporated, include: AIRCO – industrial gases, welding and cutting equipment, and acetylenic chemicals • PURECO – carbon dioxide, liquid-solid ("DRY-ICE") • OHIO – medical gases and hospital equipment • NATIONAL CARBIDE – pipeline acetylene and calcium carbide • COLTON – polyvinyl acetates, alcohols and other synthetic resins.

AN AIR REDUCTION PRODUCT

AIRCO items for inert-gas-shielded arc welding

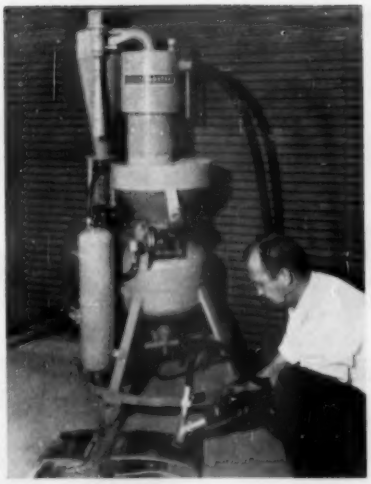


Air Reduction is your preferred source for the shielding gases you need. Argon, helium, or a mixture of gases are employed for Aircomatic, Heliwelding, and Aircospot. Airco supplies them all. Prompt bulk delivery, as well as by the cylinder, are obtainable.

Consult your Airco District Office for specific information concerning gas mixtures and recommendations based on the type of work you are doing.

Airco supplies a complete range of tungsten electrodes for AC and DC Heliwelding. Electrodes are available in pure tungsten, thoriated tungsten, (Thor-Tung) and zirconium tungsten. All three types are offered in seven diameters from .040″ to ½″ and in four lengths from 3″ to 18″. Other lengths of all electrodes on special order.

Aircomatic-Heliweld filler wire is processed to conform to the highest standards for surface finish, cast and cleanliness. Its use assures smooth, uninterrupted wire feed. Specifically designed for use in the Aircomatic manual and automatic head, and the Heliweld filler wire feeder. *Write for literature on these items.*

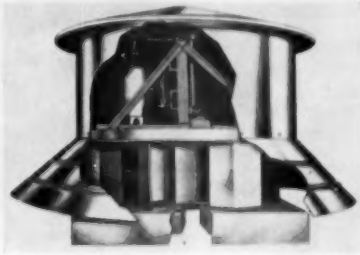


Blast cleaner

AN intermediate sized machine, the "Utility" blast cleaner is claimed to have these advantages over regular open blast cleaning: no flying dust, re-uses abrasive (steel grit), completely portable. Some applications: plant maintenance, cleaning before and after welding, removing rust and paint. *Vacu-Blast Co., Inc.*

Circle No. 57.

* * *



Air exhauster

NOISE level in roof-type exhauster is claimed to be kept to minimum by an exclusive airflow design which allows lowest possible wheel tip speeds. Air cut-off guide vanes are stationed at cut-off points simulating scroll design of a centrifugal fan housing. According to manufacturer, this accounts for its high efficiency.

Frame is of all-welded construction. Housings can be furnished in various metals. Direct-motor drive exhausters deliver from 830 to 2,590 cfm in sizes ranging from 107 to 150 with static pressures from ⅛ to ¾ in. Vee-belt drives deliver from 1,420 to 29,750 cfm in fan sizes from 122 to 440 with same static pressures as above. *Chicago Blower Corp.*

Circle No. 58.

For more information use card on page 95

FREE Do-It-Yourself Application Instructions

ON MARKET'S MOST VERSATILE

1-ROD MAINTENANCE DEPARTMENT

ALLOYS All-State FLUXES

No. 11

NICKEL-SILVER BRAZING ROD

BRAZES 14 METALS...

- Steel
- Stainless Steel
- Monel
- Nickel
- Copper
- Brass
- Bronze
- Cast Iron
- Wrought Iron
- Carbides
- Tool Steel
- Low Carbon Steel
- High Carbon Steel
- Manganese Steel

HAS THESE MANY INCOMPARABLE CHARACTERISTICS

- Tensile Strength, 85,000 psi.
- Shear Strength, 160,000 psi.
- Elongation in 2", 12.0%
- Brinell Hardness, 180
- Flows Like Silver Solder
- Resists Wear 5 times Better Than Steel
- Bonds at 1450 F.
- Takes Less Heat
- Takes Less Preparation
- Takes Less Cleaning
- Finishes Jobs Faster

A LITTLE DOES A LOT MORE

- No. 11 Costs Less Per Job
- No. 11 Goes Further—Usually 3 times
- No. 11 Saves Gases—Up To 50%
- No. 11 Saves Time —Up To 60%
- No. 11 Saves Dismantling
- No. 11 Saves Reassembly

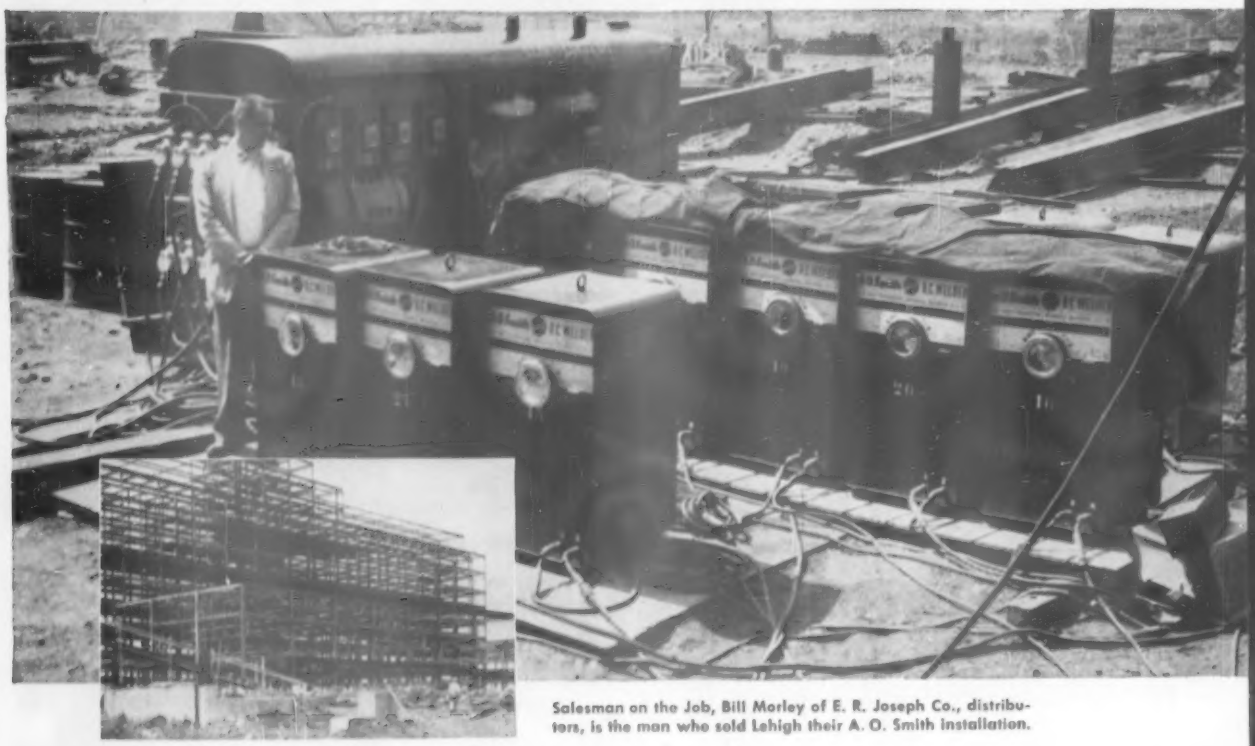
Comes Bare and Flux Coated
Sold by 700 All-State Distributors

SEND FOR Complete Application Instructions

ALL-STATE WELDING ALLOYS CO. INC.

WHITE PLAINS, N. Y.

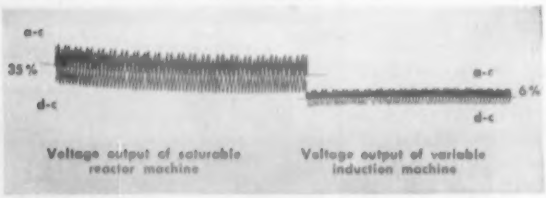
All the advantages of ...yours with A.O.Smith



Salesman on the Job, Bill Morley of E. R. Joseph Co., distributors, is the man who sold Lehigh their A. O. Smith installation.

Proof that only A. O. Smith gives you a d-c rectifier

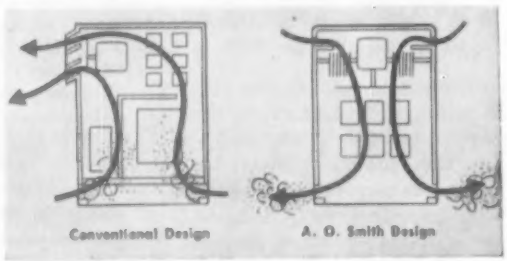
Big voltage "ripple" can keep your welding in rough water!



These oscillograms show why only A. O. Smith variable induction tranformers give you welding characteristics like those of m-g sets. The so-called d-c output of some conventional rectifiers is composed of 35% a-c — compared to only 6% a-c "ripple" in A. O. Smith's output. That's why A. O. Smith gives you a steadier arc . . . smoother welding.

The cards are stacked against you with most rectifier stacks!

Selenium rectifiers last indefinitely if properly cooled. A. O. Smith does it with *preferential cooling*—the air is directed



none of the disadvantages

rotary welding equipment
d-c Rectifier Welders

Lehigh Construction Company selects 10 all-weather A. O. Smith machines for work on large hospital-building job

BACKED by a great record of successful operation, Lehigh Construction Company is widely recognized as one of the East's top contractors. It's only natural that a stand-out performer like Lehigh should select stand-out equipment for its work.

Lehigh recently purchased 10 A. O. Smith heavy-duty d-c rectifier welders. The units are shown at left on a steel erection job for a large, new Philadelphia hospital.

This job in itself illustrates one of the big advantages offered by d-c rectifier welders. Lehigh operates 12 rectifiers off a single 125-kw diesel. With m-g sets on the job, the same diesel will handle only 10 welders — that's two extra welders at no extra power cost.

More good reasons why it pays to operate A. O. Smith heavy-duty d-c rectifier welders

• **LOWER OPERATING COSTS.** These rectifiers cost far less to run than either gas-drive units or m-g sets.

• **LOWER MAINTENANCE COSTS.** A. O. Smith rectifiers are far simpler, much easier to service. No trouble with electric motor or gas engine.

• **PORTABILITY.** Gas-driven welders and m-g sets simply cannot equal the compact, lightweight portability of A. O. Smith d-c rectifiers.

welder with superior welding performance built-in

first over the stacks. And that's *all the air* (not just part of it) — in greater quantities and at higher velocities. A. O. Smith uses a full 1/6-hp fan motor, with permanently lubricated ball bearings, and a big 18-in. blade. (Many conventional machines have only a 1/20-hp motor.) What's more, the air is cleaner because it's drawn in at the top of the case —not from ground level. Add all these up—and you see why A. O. Smith *warrants its rectifier stacks for five years.*

Built by welders — for welders

Get all the facts about the complete line of A. O. Smith a-c and d-c welding machines, electrodes and supplies. *They're built by welders — for welders!* Call your nearest distributor or write A. O. Smith Corp., Welding Products Division, Milwaukee 1, Wisconsin.

Through research ...*a better way*

A.O.Smith
CORPORATION

WELDING PRODUCTS DIVISION
Milwaukee 1, Wisconsin
INTERNATIONAL DIVISION: MILWAUKEE 1, WISCONSIN

for all 'round reliability

use ARCALOY

STAINLESS STEEL ELECTRODES . . .

One of the many steps taken to guarantee the all 'round reliability of Arcaloy electrodes is pictured here. The inspection welder makes continuous checks for arc characteristics, slag removal and weld bead appearance.

highest quality for lowest welding costs

We know *this* about ARCALOY—Alloy Rods Company's experts work continuously to guarantee the all 'round reliability and cost-saving performance of these stainless steel electrodes.

Maintaining this reliability is a must with us. Arcaloy core wire must meet rigid standards. Coatings must be formulated with exacting care—must produce a slag that is easily and quickly removed. The entire production cycle is under closely controlled quality supervision. This alone produces Arcaloy electrodes that give uniformly excellent welding, day in and day out. This alone is your guarantee of highest quality for lowest welding costs.

Buy Arcaloy Stainless Steel Electrodes from your Alloy Rods Distributor today. They are available for all grades of chrome-nickel and straight chrome stainless steels with either AC-DC or lime coatings.

OVEN FRESH! ARCALOY Electrodes are packaged in the familiar ALLOY RODS red-and-yellow hermetically sealed metal containers. Available in 1/16", 5/64", 3/32", 1/8", 5/32" and 1/4" diameters.

Alloy Rods Co.

General Offices and Plant • York 2, Penna.

Pacific Coast Sales Offices and Plant • El Segundo, Calif.

ARCALOY Stainless Steel Electrodes
BRONZE-ARC Bronze Electrodes
NICKEL-ARC Electrodes for Cast Iron
TOOL-ARC Electrodes for Tools and Dies
WEAR-ARC Hard-Facing Electrodes
WELD-ARC Low Hydrogen Electrodes
CUT-ARC Cutting Electrodes

no finer electrodes made . . . anywhere

Represented in Canada by: Canadian LIQUID AIR COMPANY, Limited BRANCHES, PLANTS, WAREHOUSES AND DEALERS, COAST TO COAST

All-purpose welder

ARC welder provides a choice of a-c or d-c welding current. The new machine, called the "Idealarc," is said to provide an ideal welding arc for every type of manual welding application, permitting selection of either a soft or forceful arc.

The machine is available without the d-c current. To this unit a d-c package can be easily attached in about an hour whenever desired. It is also available as a combination a-c and d-c machine with selection of current made through a switch handle.

For a-c welding jobs the machine provides a single-phase transformer type welder, designed to give greater arc stability. The machine produces an exceptionally smooth spray type of transfer of metal, according to manufacturer. "Idealarc" also has an arc booster switch for selecting normal or "hot" starting. The new machine, it is claimed, will permit using, to their maximum advantage in speed and quality, the iron-powder type electrodes.

Current models available are 300, 400 and 500-amp a-c, combined with d-c capacities in 200, 300, 375, and 450 amp. *The Lincoln Electric Co.*

Circle No. 59.

* * *

Electrode container

COMPLETE protection in shipment and in storage is said to be provided by a new package designed for "Airco" stainless-steel electrodes. Tubular container, which holds 10 lb of electrodes, is composed of two seamless sections of impact extruded aluminum. They are sealed airtight with waterproof adhesive tape, which can be used to reseal the tube. *Air Reduction Canada Ltd.*

Circle No. 60.

Propane torch

"FIRE Gun" is a new, portable hand-operated heat tool that is claimed to burn clean, low-cost propane with a heat range of 4,000 to 117,000 BTU per hour. This trigger-controlled gun can be used for soldering, tinning, brazing, preheating, thawing, plasticizing and paint removal. The 3,650 F flame leaves no carbon deposit or "blackened area," manufacturer states.

Basic kit includes a heat concentrator tip, a high heat or blow torch tip, a soldering iron tip which is equivalent to a 12-lb commercial iron, hose, regulator, pressure gage, and steel box. *Fire Gun Sales Corp.*

Circle No. 61.

* * *

Track for clamps

STEEL track for "Jorgensen" hinged clamps now makes it possible for lengthwise or "sideway" adjustment. In jigs of fixtures, the user can have his clamps always at hand, easily brought up to the work. This type of clamp is hinged so that it swings on its mount up to clamping position or swings out of way when not in use. Now, instead of being fixed to underside of bench or fixture, the clamp is located within track that is fixed. *Adjustable Clamp Co.*

Circle No. 62.

* * *

Goggle bands

FOUR flat elastic head bands for replacement purposes on goggles come in sealed sanitary packages, 12 packages in a carton. Each band is equipped with proper fasteners, including a positive "grip tight" adjustment buckle, which cannot slide or become loose after once adjusted to fit the head, according to manufacturer. *Sellstrom Mfg. Co.*

Circle No. 63.

For more information use card on page 95

"If I were the boss, I'd order

NICKEL-ARC

for all cast iron welding"

No wonder the welder himself prefers Nickel-Arc electrodes for welding cast iron. Nickel-Arc has a low-penetrating, easy-to-control arc, with a smooth, steady metal transfer and good wash characteristics. And his Nickel-Arc welds are completely free of cracks or porosity.

But the boss has even *more* reasons for specifying Nickel-Arc. *Better machinability*, the result of the special core wire and coating of Nickel-Arc, cuts his machining cost, improves appearance. And the *confidence* of his welders in the finer performance of Nickel-Arc electrodes guarantees better workmanship on their part.

Standardize on Nickel-Arc, the electrode that is best for machineable welds in cast iron. Order Nickel-Arc from your nearby Alloy Rods Distributor or write the plant for information.

OVEN FRESH NICKEL-ARC Electrodes are packed in hermetically sealed metal containers in 3/16", 5/32", 1/4" and 5/32" diameters.

Alloy Rods Co.

General Offices and Plant • York 2, Pa.
Pacific Coast Sales Offices and Plant • El Segundo, Calif.

ARCALOY Stainless Steel Electrodes
BRONZE-ARC Bronze Electrodes
NICKEL-ARC Electrodes for Cast Iron
TOOL-ARC Electrodes for Tools and Dies
WEAR-ARC Hard-Facing Electrodes
WELD-ARC Low Hydrogen Electrodes
CUT-ARC Cutting Electrodes

no finer electrodes made . . . anywhere

Represented in Canada by: Canadian LIQUID AIR COMPANY, Limited BRANCHES, PLANTS, WAREHOUSES AND DEALERS, COAST TO COAST

NOW...
WITH ONE MACHINE
YOU CAN SELECT
the ideal arc
AC or DC
for every job with
LINCOLN
IDEALARC®

4 types of arc at your fingertips

★ AC SOFT ARC

★ AC FORCEFUL ARC

★ DC SOFT ARC

★ DC FORCEFUL ARC

TO THE MAN WHO USES AC

For the first time . . an AC welder with truly stable arc *—plus* choice of soft arc for smooth, clean welds; forceful arc for maximum in penetration and non-sticking operation.

TO THE MAN WHO USES DC

For the first time . . . a heavy duty, dependable DC welder that combines the efficiency of the rectifier with versatility of selecting a soft and forceful arc. *Then you can switch to AC instantly, where the job can be done better with AC.*

TO THE MAN WHO USES BOTH AC AND DC

For the first time . . . in *one* machine, both AC and DC with selection of soft arc or forceful arc in either AC or DC. Gives you the ultimate in speed, ease, low cost.

START CUTTING COSTS . . . NOW!

Send for Bulletin 1343 showing how hand welding can be simplified, done faster, for lower cost. Write.

GET THE FACTS
SEND FOR BULLETIN 1343

THE LINCOLN ELECTRIC COMPANY

Dept. 1701 • Cleveland 17, Ohio

The World's Largest Manufacturer of Arc Welding Equipment

You Can't Beat ATLAS Quality

The modern Atlas plant is devoted exclusively to building the finest weld cleaning tools in America. There are models to suit the man and every type work. If you haven't tried Atlas you don't know what a difference "balance and feel" can make in production and quality of work. They can take it.

ATLAS WELDING ACCESSORIES CO.

707 E. LEWISTON AVENUE, FERNDALE 20 (DETROIT) MICH.

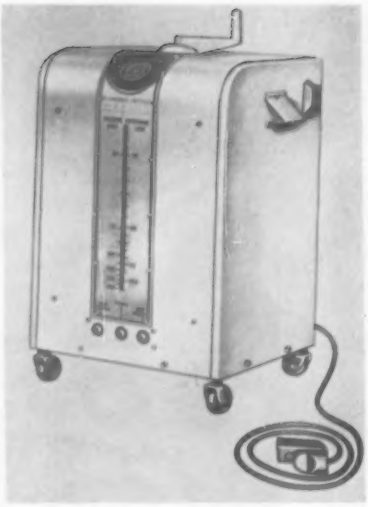
ASK YOUR WELDING SUPPLY DEALER TO SHOW YOU THE ATLAS LINE

B-1 "Re-Bit" Dual Tool 10½" 16 oz.
B1-W "Re-Bit" Dual Tool 10½" 15 oz.
Model A Dual Tool 10½" 17 oz.
Model AW Dual Tool 10½" 16 oz.
Model E-1 "Re-Bit" 9" 12 oz.
Model E1-W "Re-Bit" 9" 10 oz.
Model F-1 "Re-Bit" 10" 16 oz.
Model F1W "Re-Bit" 10" 14 oz.
Model G Chisel & X-Chisel 9" 14 oz.
H-9" 14 oz. L-10" 17 oz. Cone & Chisel
Model I Chisel & X-Chisel 9" 13 oz.
J-9" 13 oz. N-10" 15 oz. Cone & Chisel
LCP-10" 17 oz. HCP-9" 14 oz. Cone & X-Chisel
Model K Cone & X-Chisel 10" 17 oz.
JCP-9" 13 oz. NCP-10" 15 oz. Cone & X-Chisel
Model M Chisel & X-Chisel 10" 15 oz.
Models WH: 10-20-30 12" 14 oz.
Model C "Re-Bit" Chisel & symbol
Model CW "Re-Bit" Chisel & symbol
Models OCC—OCP—ODC 9½" 10 oz.

ASK YOUR WELDING SUPPLY DEALER

A good weld cleaning job performed with good professional tools will better reveal the quality of the weld

You Can't Beat ATLAS Quality



A-c welder

GENERAL-utility a-c arc welder, called the "Busybee," is designed for use in shops, garages, on ranches and farms. Two models are available—one with and one without power factor correction. Units operate on a 3-kva or larger transformer. Right "heat" can be selected by simply turning current—control crank for exact increments from 20 to 180 amp. Open circuit voltage is adequate for successful operation with standard electrodes, it is claimed. *Air Reduction Sales Co.*

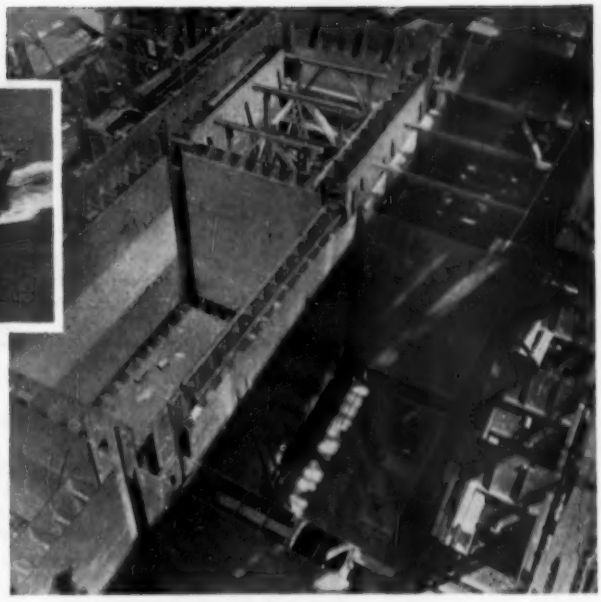
Circle No. 64.

* * *

Soapstone holder

THIS holder for soapstone is said to protect the marking material from breaking and from being mislaid. It also enables weldors to use short ends. Holder is rigid metal, has a spring clip for carrying it in the pocket where it is always handy, and has a button slide in back so the soapstone can be readily expelled as it wears down. *Atlas Welding Accessories Co.*

Circle No. 65.



Over 1½ tons of Inco Wire and Electrodes used in welding giant nickel-lined ship tanks, and...

Every weld Passes rigid tests

In building the 18,000-ton Marine Dow-Chem, special attention was given to her four aft tanks. These tanks would carry 73% caustic soda, a hot corrosive cargo! They had to be made of corrosion-resisting Nickel and Nickel-clad steel to protect purity. And for the same reason, iron dilution of welds in the nickel cladding could not be over 5%.

Welds of varied type and method were made with Inco materials developed for welding Nickel and nickel cladding — metal-arc welding with Inco "141" and "131" Nickel Electrodes, inert-gas tungsten arc welding with Inco "61" Nickel Wire, and inert-gas consumable electrode welding with spooled "61" wire. When it was all done, 3350 lbs. — over 1½ tons — of wire and electrodes had been used. *AND NO WELDING HAD TO BE DONE OVER!*

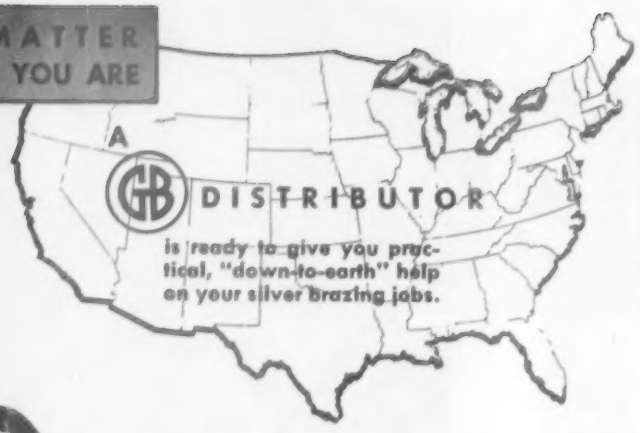
Iron dilution was kept below 5%, ranging from about 2.5% at the start to an average of less than 1% later! The secret of the low dilution was chipping out *half of every first pass* on the nickel clad side. Then about three more passes were used to fill the groove.

When *you* weld Nickel and high-nickel alloys, get the best results with least difficulty, by using Inco Welding Products. And write today for the newly revised edition of our *Welding Bulletin, T-2.*

THE INTERNATICNAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

INCO TRADE MARK **Welding Products**
Electrodes . . . Wires . . . Fluxes

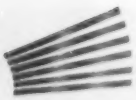
NO MATTER WHERE YOU ARE



A GB DISTRIBUTOR is ready to give you practical, "down-to-earth" help on your silver brazing jobs.

GB's Distributor Sales Organization is made up of experienced salesmen who have a broad background of practical operating experience, as well as technical training, in silver brazing applications. One of those men is in your area—and he wants to work with you to find how GB Silver Brazing Alloys and GB Fluxes will speed up your operations, give you maximum results and save you money.

Each GB standard Silver Brazing Alloy is developed for specific cost and production requirements. They are all available in these easy-to-use forms . . . wire in coils or straight lengths, strips, sheets, simple or intricate formed pieces.



Call in your GB distributor for all the facts about the GB line—he'll gladly supply you with working samples of GB alloys and fluxes, as well as give you helpful assistance on any brazing problems you may have. (If you don't know his location, simply write us and we'll send his address.)

GB FLUXES . . . available in three main types to cover the low temperature silver brazing range:
GB No. 99—working range up to 1350° F
GB No. 88—working range up to 1650° F
GB No. 27—working range up to 2000° F

GB FLUXES . . .
Dissolve metallic oxides readily
Provide uniform flow of silver brazing alloy
Insure high joint strength

GB FLUXES

The physical properties and appearance of a brazed joint are controlled to a large degree by the flux which is used. For this reason it will pay you to team-up GB Flux with GB Silver Solder—they were developed to produce maximum results when used together.

GOLDSMITH BROS.
SMELTING & REFINING CO.
1300 W. 59th, CHICAGO, ILL.
Suppliers of Precious Metals to Industry Since 1867

Stress analyzer

PORTABLE stress analyzer using X-ray diffraction method is for field and plant operations. Known as the "Androscope," it measures the magnitude and sense of residual stresses in metals, plastics and other materials. The instrument readily distinguishes between tensile and compressive stresses, according to manufacturer.

Stresses are recorded visually on film in 10 to 20 minutes. Rapid comparator provides quantitative measurement. Magnitude of stress in psi's is determined from simple formula using figure from comparator. *Holger Andreasen, Inc.*

Circle No. 66.

* * *

Face shield

QUICK interchangeability of a general purpose window, a window for heat protection, or a special window for acetylene welding or scarfing is provided for in a new face shield. Called the "Monarch," it also has a spark deflector. Headgear is form fitting and offset-hinged at the friction joints. The rear headband section adjusts easily to securely anchor the shield with minimum pressure, manufacturer states. Comes in four models. *The Fibre-Metals Products Co.*

Circle No. 67.

READ ALL ABOUT IT!

Write now for up-to-the-minute literature pertaining to any product in M & T's comprehensive line of Murex electrodes for arc welding—Rods and Wire for gas, submerged arc and inert arc!

Specific new catalogs cover electrodes for mild steel and low alloy—coil wire for submerged arc welding, stainless steel electrodes and bare wire, aluminum and phosphor bronze electrodes and bare wire, aluminum electrodes and bare wire, electrodes for cast iron, gas rods, tungsten rods, etc. Each gives full information, including physicals, chemical analyses, qualifications, sizes and procedures as well as general engineering data.

Make your welding operation easier by having helpful reference material at hand. An M & T representative or distributor will be glad to supply your needs.

METAL & THERMIT CORPORATION

100 EAST 42nd STREET • NEW YORK 17, N. Y.

MUREX ELECTRODES • ARC WELDERS • ACCESSORIES

TUNGSTEN ELECTRODES MAY *LOOK* ALIKE

But Have You Tried

THESE NEW ONES by

ELMET

Even if you judge tungsten electrodes by *appearance* alone, you'll like the new ELMET Efficiency Electrodes. In "cleaned finish," they are made with a clean metallic surface free of imperfections. "Centerless ground" electrodes are further processed to produce a mirror smooth ground surface.

When you judge by *performance*, you'll find that ELMET Electrodes stand in a class by themselves. Their uniformity of properties, dimensions and characteristics prevent loss of time due to readjustments of equipment and voltage.

Rod diameters are held within specified diameters and limits of straightness, thus assuring good fit and uniform feed adjustment. Furnished in cleaned finish and centerless ground finish. Available in packages of 10 in all standard diameters from .040" to ¼" and from 3" to 18" in length. North American Philips Company, Inc., Elmet Division, Lewiston, Maine.

Try New ELMET Electrodes Now!

USE COUPON BELOW

Free Folder

Don't delay! Do it today! Send the coupon and get the facts about ELMET Efficiency Electrodes.

Distributor Inquiries Invited

Date_____

NORTH AMERICAN PHILIPS CO., INC.,
Box 1041C, Lewiston, Maine.

Please send me ☐ *Free Folder and*

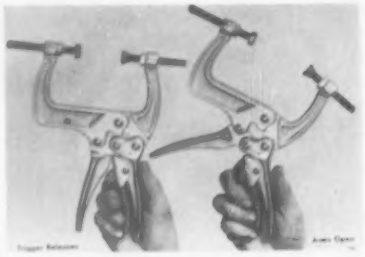
☐ *Price on* _____ *Elmet Electrodes.*
(quantity, size, finish)

Name_____

Street_____

City_____ State_____

☐ *Send me your distributor proposal.*



Toggle clamps

THREE "trigger-release" portable plier-type toggle clamps have been added to the "De-Sta-Co" line. These enables the operator to hold the workpiece with one hand, and clamp and release with the other. A touch of the trigger throws the jaws of these clamps open—ready for the next clamping action—manufacturer states.

Known as "Models 482, 484 and 486," the clamps are claimed to develop great holding pressures. *Detroit Stamping Co.*

Circle No. 68.

* * *

Mig welding wire

AT the recent Metal Show in Chicago, this firm announced the availability of development quantities of an "activated" electrode of mild-steel wire for use in its Mig (metal inert-gas) welding process. Activation agents change burn-off rate so that stable spray-type transfer can be obtained on d-c straight polarity without need for oxygen additions to the shielding gas. Because these agents modify the penetration pattern, other activated wires will find many uses in welded build-up applications requiring minimum base-metal pick-up, according to manufacturer.

In addition, these wires are said to permit use of the process with standard a-c welding power supplies. *Air Reduction Sales Co.*

Circle No. 69.

* * *

Welding analyzer

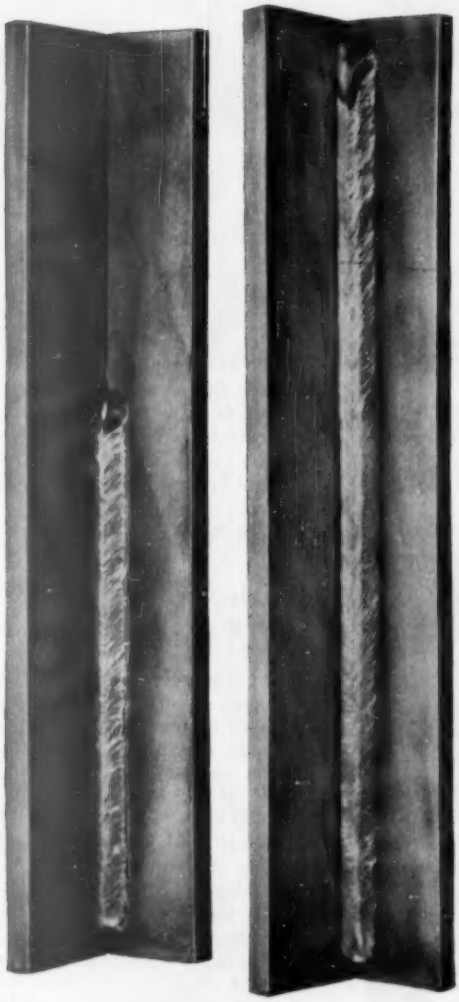
USEFULNESS of this firm's welding instrumentation is extended by new "Welding Analyzer Model BL-213." The instrument records welding current and electrode pressure in operation of spot and seam welding equipment. Its primary purpose is to measure and record magnitude and timing of welding variables, consistency of operation of the equipment, and its calibration. Analyzer's net weight is 89 lb. *Brush Electronics Co.*

Circle No. 70.

For more information use card on page 95

WELD WITH WESTINGHOUSE

Up to 60% greater deposit rates with Westinghouse ZIP-27*



Fillet made with ordinary rod.

Fillet made with ZIP-27.

Because:

FACT 1: Westinghouse ZIP-27 electrodes give 50% more fillet weld feet per electrode. Slag easily removed. High speeds possible in skip and tack welding; also, ideal for "drag technique."

FACT 2: Westinghouse ZIP-27 strikes instantly. X-ray quality welds with ductility of 25-30% are obtained. Even inexperienced operators can make smooth, high-quality, balanced fillets with minimum spatter.

PROVE IT TO YOURSELF!

Write us on your company letterhead. Ask for free samples ZIP-27 rod. Ask for free booklet, *Westinghouse ZIP-27 Electrodes.* Your copy will be sent by return mail. Or send coupon below. J-21866

* Powdered iron-coated electrode

YOU CAN BE SURE...IF IT'S

Westinghouse

Westinghouse Electric Corporation
Welding Division Buffalo, N. Y.

- ☐ Send FREE ZIP-27 booklet
- ☐ Send FREE ZIP-27 rod samples
- ☐ Have welding specialist call

Name _____ Title _____

Company _____

Street & No. _____

City _____ Zone _____ State _____

WE-2-55

UNITED'S PHOSON BRAZED JOINTS

for **Pressure Piping**

Mean Continual

Trouble-free Operation at

Manhattan House

New York Life Insurance Co.'s Modern 20-Story Apartment in New York City

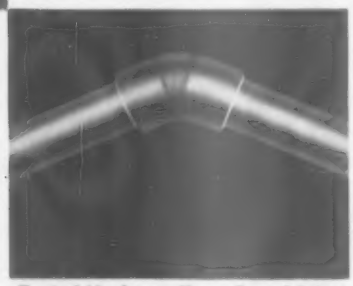
Here is proof positive of PHOSON'S dependable, low-cost efficiency!

Engineering specifications for Manhattan House specified all joints be brazed between copper tubing and threadless wrought copper fittings and cast bronze valves for the forced hot water heating system to be operated at 115 PSI at a temperature of 240°.

Brazed joints were specified to assure strong non-corrosive permanently safe construction . . . and PHOSON was specified because it had the highly dependable physical properties so necessary and the joints could be brazed rapidly and at low cost!

PROVE PHOSON IS BEST FOR YOUR JOB — LARGE OR SMALL!

Contact your UNITED Welding Supply Distributor



Typical Manhattan House Brazed Joint

UNITED WIRE

AND SUPPLY CORP.
Brazing Alloy Division
PROVIDENCE 7, R. I. • OFFICES IN PRINCIPAL CITIES

Ask to see the new United Wire color film "When Metals are Brazed". Write for showing dates and literature.

Permanently United

SEND FOR SPECIAL PHOSON FOLDER NOW!

Hardness tester

PORTABLE, lightweight hardness tester is said to make accurate Brinell tests on all non-ferrous alloys. Removable test head makes it possible to test parts of any size or shape, and the precision instrument can be used in any position, even upside down, with or without the base, according to manufacturer. Unit weighs only 26 lb. *Andrew King.*

Circle No. 71.

* * *

Welding gantry

THIS specially designed gantry for semiautomatic welding units features a rapid, three-dimensional adjustment of the welding gun, manufacturer states. The unit is designed for use on pipe fabrication and circumferential welds of any kind. Welding gun also attaches to the torch holder for use on a Radiagraph machine for straight-line welding. *Automatic Welding Co.*

Circle No. 72.

* * *

Brazing alloy

SILVER brazing alloy, known as "RSNI," has been specially developed to overcome crevice corrosion problems in brazing the 400 series straight chromium stainless steels. The new alloys contain 63% silver, 28.5% copper, 6% tin and 2.5% nickel. It melts at 1,325 F and flows at 1,475 F.

The alloy does not flatten out at brazing temperature to form thin fillet edges as do most similar alloys. This is the characteristic that aids in preventing crevice corrosion, but particular care must be exercised to flow the alloy into the joint because of this sluggishness. Available in wire of any standard gage. *Handy & Harman.*

Circle No. 73.

FOR PORTABLE GRINDERS

COLONIAL WHEELS . . . Equipped with GRINDAWAY* Safety Rings . . . PROVIDE AN INCREASED SAFETY FACTOR!

Increased safety in grinding wheels is now available! Colonial reinforced resinoid wheels for high speed, portable grinding are equipped with the revolutionary GRINDAWAY safety rings to provide greater safety at no sacrifice in grinding quality!

Made of a material having greater tensile strength than steel, Colonial GRINDAWAY safety rings can be inserted in the wheels where reinforcement is most needed . . . *in the actual grinding portion of the wheel.* This is possible since they abrade away as the wheel wears through them. Such reinforcement in the actual grinding portion of the wheel has never before been possible.

Colonial Abrasive Products Company offers GRINDAWAY safety rings in three types: straight, recessed, and flaring cups with grinding quality maintained in each and without premium cost.

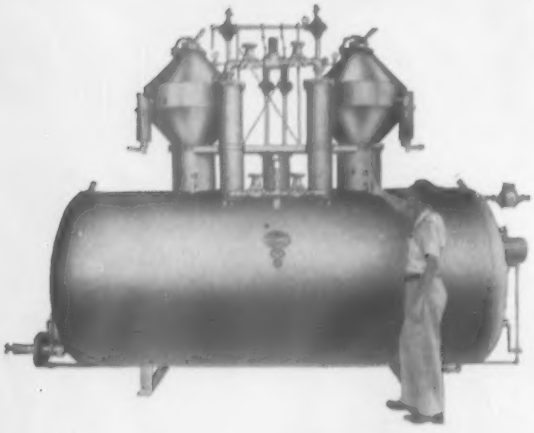
New literature is available describing the construction, advantages, and prices of each type Colonial GRINDAWAY wheel. We invite you to write for your copy today.

*PATENT APPLIED FOR

COLONIAL ABRASIVE PRODUCTS CO.
SIXTH AND HARRY STREETS
CONSHOHOCKEN PENNSYLVANIA

designed for

modern acetylene production



Sight Feed

MODEL A-TWIN GENERATOR

for pipe-line distribution

If you're modernizing present shop facilities or enlarging acetylene production, investigate the Model A-Twin Generator. When requirements demand, acetylene can be produced continuously, without necessity of shut-down during recharging. Operation is safe and virtually automatic, requiring a minimum of attention and maintenance. No tank purging... No waste of acetylene.

Your welding supply distributor will be glad to discuss the economy and convenience of the Model A-Twin with you. Ask him for literature and our print No. 210-10-A, suggesting arrangement of a Model A-Twin and pipe-line system in your plant. If unavailable locally, write or phone

WELDING Sight Feed EQUIPMENT

THE SIGHT FEED GENERATOR CO.

55 East Third St.

WEST ALEXANDRIA, OHIO, U.S.A.

Hardfacing rod

"WALLOY" No. 6" is a chrome-cobalt-tungsten hardfacing alloy for general applications where wear and corrosion resistance are required. It is available as a rod for oxyacetylene torch application and is recommended for use on edger rolls, swaging mandrels, engine exhaust valves and seats, and hot-work tools.

As deposited, the alloy has a Rockwell C hardness of 40-44. Other properties: 105,000-psi tensile strength; 8.3 specific gravity; and 2,325-F melting point. Rod comes in diameters of 3/16, ¼, 5/16 and ⅜ in. and is packed in 10-lb containers. Alloy can also be obtained in cast form to customer specifications or in raw form as shot for casting fabrication. *Wall Colmonoy Corp.*

Circle No. 74.

• • •

Safety goggles

SAFETY clip-on, called "Tuc-Over," provides shatterproof lenses in an unbreakable frame of tough, resilient polyethylene that is so light it floats, according to manufacturer. It snaps on or off prescription frames quickly and is held firmly in place by plastic clips, which won't scratch frame or lenses.

"Tuc-Overs" are made in two sizes to fit all prescription-glass frames. Lenses are available in light or medium green, and the frame in translucent white or green. *Watchemoket Optical Co.*

Circle No. 75.

• • •

A-c, d-c electrode

"EUTEC-HandOmatic 2," is a new a-c, d-c contact-arc gap electrode for welding carbon steel. Rapid deposition, excellent weld appearance and automatic slag removal are features claimed for it. Slag coverage is 100% without slag inclusion, according to manufacturer. Slag curls and removes automatically even when beads are run side by side, as in cladding and when base metals are hot. Slag also lifts on fillet welds. *Eutectic Welding Alloys Corp.*

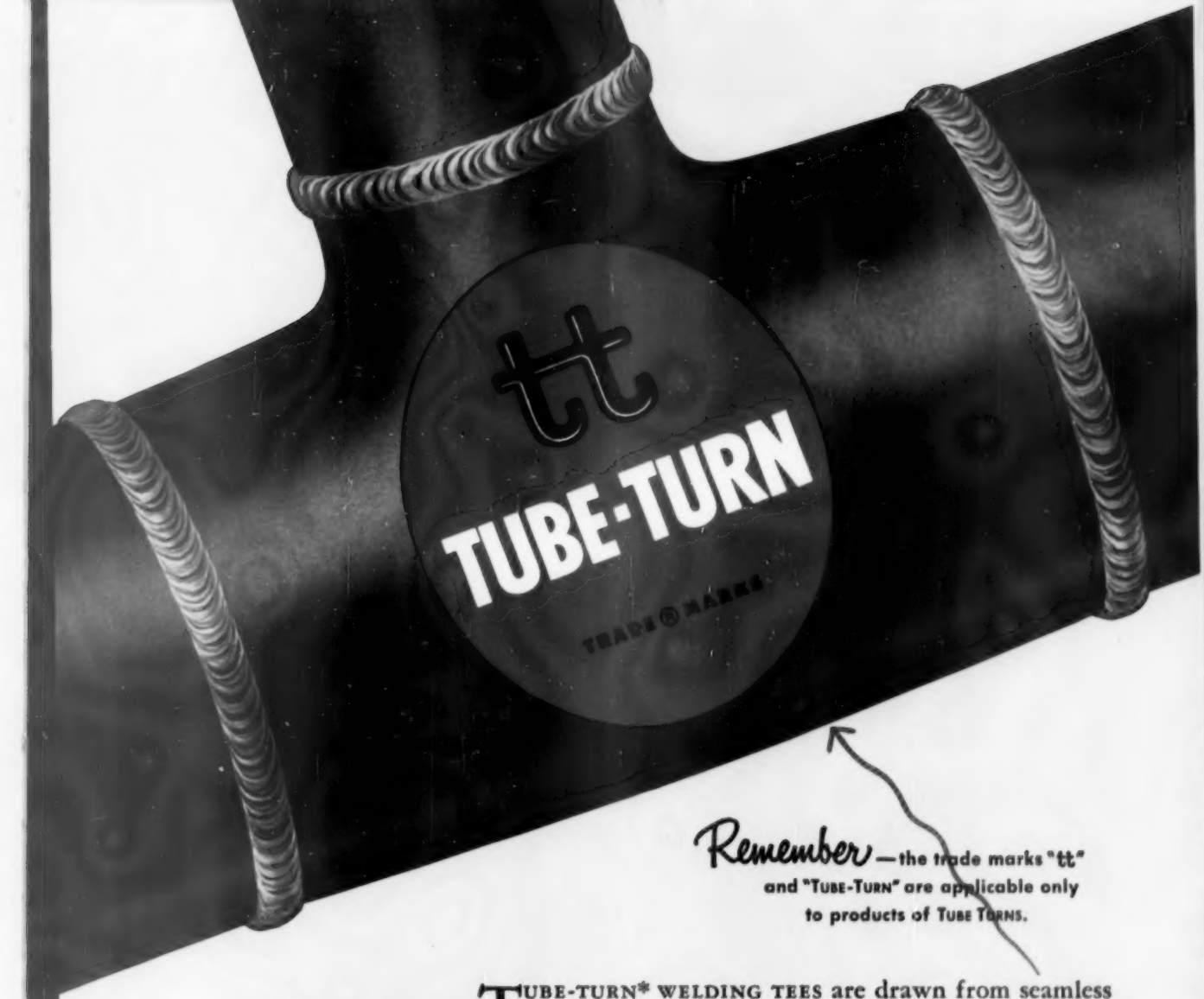
Circle No. 76.

• • •

Moisture tester

THIS device determines amount of moisture in coatings of stainless, nonferrous and low-hydrogen electrodes. Manufacturer says it is quick and accurate. *Weldrod Co.*

Circle No. 77.



Remember—the trade marks "tt" and "TUBE-TURN" are applicable only to products of TUBE TURNS.

You get extra strength with *The Leading Brand*

TUBE-TURN* WELDING TEES are drawn from seamless tubing to a barrel shape. This, and other design features produce high strength—averaging over 25% more than required by applicable standards.

Specify TUBE-TURN Welding Fittings and Flanges for extra values: superior products, the exact fitting or flange you need from our complete line, outstanding engineering service. Call your nearby Tube Turns' Distributor. He is at your service!

The Leading Manufacturer of Welding Fittings and Flanges

TUBE TURNS

LOUISVILLE 1, KENTUCKY

A DIVISION OF NATIONAL CYLINDER GAS COMPANY

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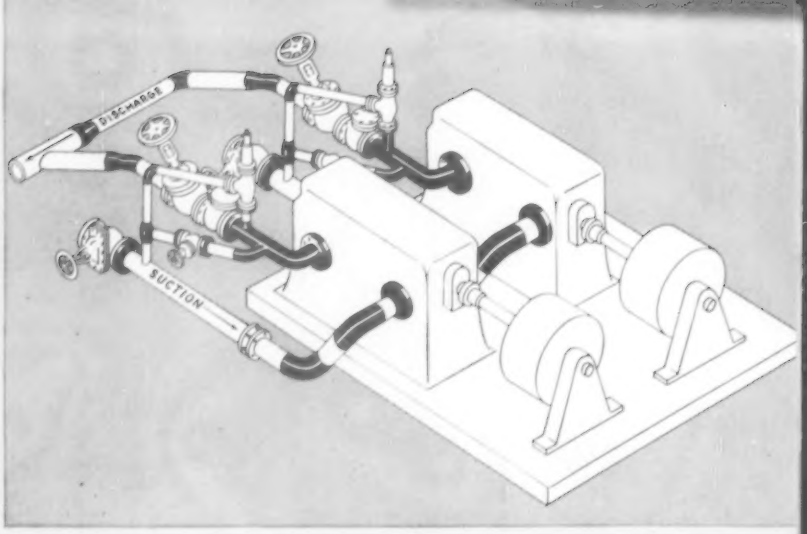
EXTRA VALUES

Speed up your piping jobs with TUBE TURNS' SERVICE



ENGINEERING SERVICE—Tube Turns' Engineering Service can help you on your piping projects. For example: Diagram above shows an application where TUBE-TURN® Welding Fittings and Flanges simplified the design and erection of pump piping. They save time, save space, and make the piping permanently leakproof and reliable. Ask your Tube Turns' Distributor to give you the pump piping recommendations of Engineering Service.

COMPLETE LINE SERVICE—You can make sure of getting the right fitting for each job when you specify "TUBE-TURN". This is the world's most complete line of welding fittings and flanges, including more than 4000 items, in all piping materials, schedules, and sizes.

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Tube Turns is recognized as a leading source of authoritative information on piping design. For booklet on "Allowable Working Pressures", fill out and send the coupon now.

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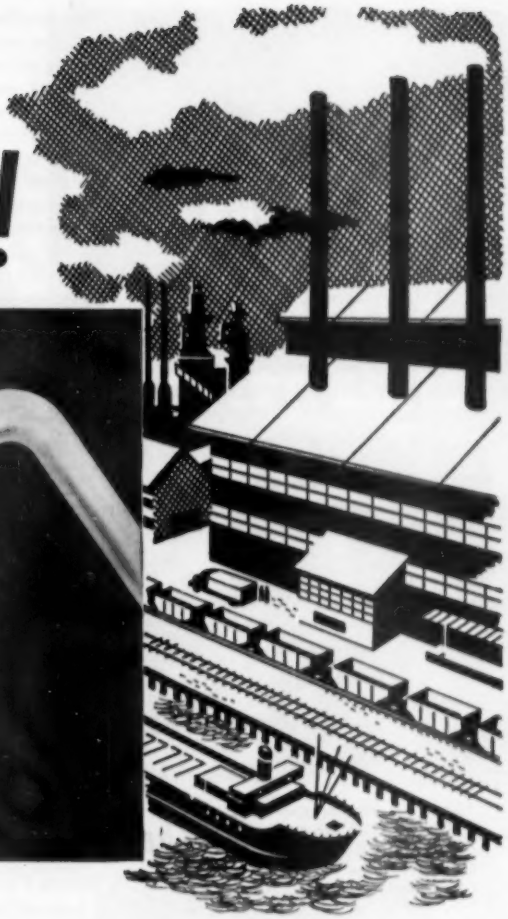
A DIVISION OF NATIONAL CYLINDER GAS COMPANY

LOUISVILLE 1, KENTUCKY

TERRIFIC HEAT !



HARRIS SUPER-HEAT TORCH NO. K23

Heat is the Prime Factor utilized in connection with innumerable Metal Working Operations. While it is a fact that the Oxy-Acetylene Welding Torch is universal in its applications, there are many Operations requiring a much greater volume of Intense Heat than can be obtained from a Welding Torch.

A definite limitation exists relative to the amount of Oxygen and Acetylene Gases which can be safely mixed without danger of the Flame "Back-firing", due to the extremely fast Flame Propagation Characteristics of such Gas Mixtures. On the other hand, much larger volumes of such Fuel Gases as Propane, City Gas and Natural Gases can be safely mixed with Oxygen on account of their lower rate of Flame Propagation. It is evident the larger the volume of Gases mixed, the greater the Flame and resulting Heating Value. This produces the truly phenomenal results achieved by this Harris Super-Heating Torch.

The applications of this Harris Torch are unlimited, where large volumes of Intense Heat are required, either as a Portable or Stationary Unit. In places where Massive Shafts are to be Straightened; Large Size Pipe Bent; Flanging or Straightening of Steel Plates; Brazing Heavy Copper Pipe, etc., etc., this Harris Torch, with its **TERRIFIC HEAT**, is the answer.

HARRIS 1903 50 1953 ANNIVERSARY

SEND FOR DESCRIPTIVE FOLDER NO. 540710

THE HARRIS CALORIFIC COMPANY
CLEVELAND 2, OHIO

NEWS . . . . . *from page 6*

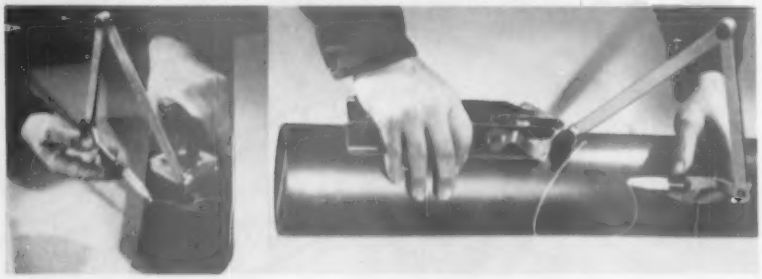
manager at Caterpillar Tractor Co., Joliet, Ill., who will discuss "Applying Quality Control Welding in the Heavy Equipment Field;" Theodore Gaynor, supervisor of the inside shops for Bethlehem Steel Co., Johnstown, Pa., "How Welding Slashes Steel Mill Maintenance"; and Perry C. Arnold, welding engineer at the Chicago Bridge and Iron Co., "Building and Equipping a Welding Research Laboratory."

More than 250 persons are expected to attend the conference. Sessions will be in the Chemistry Building auditorium, 3255 S. Dearborn.

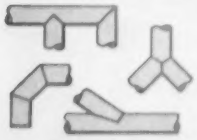
The conference is expected to attract members of American Welding society sections from the following Midwest cities:

Western Michigan section at Grand Rapids; Iowa-Illinois section, Davenport, Iowa; Iowa section, Des Moines; Peoria section, Peoria, Ill.; Sangamon Valley section, Springfield, Ill. Anthony Wayne section, Fort Wayne, Ind.; Indiana section, Indianapolis; Michiana section, South Bend, Ind.; Louisville, Ky., section; Milwaukee section; Fox Valley section, Appleton, Wis., and the Northwest section, Minneapolis.

LAY OUT ANY PIPE JOINT



LAY OUT ANY PIPE JOINT, SHOWN BELOW, on any size pipe from 1½" to 48"



Mark Structurals
Adapter for marking structural angles included with either model of the Contour Marker.

The proven, fast easy way

IN LESS THAN 5 MINUTES you can lay out a Y, a T, an L or any angle joint with a Contour Marker. IT'S EASY and absolutely accurate; it is calibrated in both degrees and pitch. Just set the angle and with a smooth swing of the Contour Marker's soapstone point you are ready to cut! You save "man hours" as well as oxygen and acetylene gas because "cut and try" methods are eliminated.

Two Sizes: Standard, for pipes 1½" to 18" dia.; Jumbo, for pipes 16" to 48". Instruction book included. Belt case available. Write for information.

Sold by welding supply dealers everywhere.

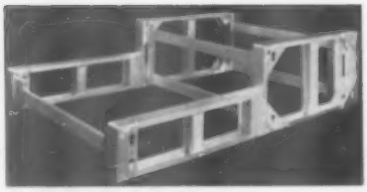
CONTOUR MARKER CORP. OF CALIFORNIA
1843 East Compton Boulevard, Compton, California

BOYCE CENTERING HEAD marks center line at any degree of angle on pipe, shaft, tube. Leveling gauge on dial.

24" RADIUS MARKER is folding compass of Dural aluminum. Folds to 9¼" pocket size; weighs 8 oz.

PIPE FLANGE ALIGNER expands and centers inside pipe to align flange for welding. For any pipe dia. 3" to 12"

THE *Original* CONTOUR MARKER
ACCURACY PROVED BY TEN YEARS OF SERVICE TO WELDERS



UN's 4-level stage is welded aluminum

Aluminum's versatility and practicality has been demonstrated once again in the fabrication of the demountable stage in the General Assembly Hall of the United Nation's Building.

The unique four-level stage of almost 2,000 sq ft was donated by Thomas J. Watson, board chairman of IBM Corp. The contract to provide the new stage was undertaken by the R. D. Werner Co., Inc., New York City, producers of aluminum extrusions, ladders and metal mouldings. They, in turn, arranged with The Oiljak Mfg. Co., Inc., Montclair, N.J., to accomplish the necessary design work and to fabricate the structural aluminum components supporting the hard maple stage floor.

The initial assembly of the complete stage was accomplished by UN personnel in eight hours. The design for interlocking the 448 welded aluminum assemblies of 59 different types was accomplished without the use of special handling equipment. Each component was designed so that it could be handled by one man. The design and fabrication of the inert-gas welded 61ST aluminum structural pieces cost less than the hard-maple flooring of the stage.

* * *

2 new welding-equipment firms in Florida

Two new firms which manufacture welding and cutting torches and tips were recently established in Florida. They are Universal Cutting & Welding Equipment Mfg. Co., Fort Lauderdale, and Flame Cutting Equipment Co., Dania. The latter's sales and engineering offices are located in Detroit, Mich.

* * *

Resinous adhesive joins certain types of metals

Recent reports out of Washington, D. C., tell of a new resinous-type adhesive that may replace soft solder in some applications. The Army developed the resin for joining certain metals used in part of the tail-fin assembly of bombs. Known as "Araldite 115, an epoxide resin," the adhesive is also said to cut costs.

INVINCIBLE

WELDING FLUX RECOVERY UNITS

quickly pay for themselves!

The American Welding and Manufacturing Company, Warren, Ohio, has used Invincible units for several years along with their submerged arc welders. They report that:

1. The Invincibles recover *all* the unfused flux for re-use.
2. The quality of recovered flux is high for Invincibles return only slag-free, usable material to the hopper of the welder.
3. The operator removes unfused flux from area of weld so he can concentrate entirely on his work.

Two machines used by this manufacturer salvage about 100 lbs. of material daily. So, within a few months the value of the flux recovered was equal to the price of the Invincibles. Since then, they have made important savings while giving trouble-free service.

WRITE FOR FOLDER on all types of Flux Recovery Systems.

Model 490 designed especially for use with portable welding equipment.

INVINCIBLE VACUUM CLEANER MFG. CO.

DOVER, OHIO

OVER 50 YEARS THE LEADER IN INDUSTRIAL VACUUM EQUIPMENT

Tempilstik°

FOR ALL HEAT-DEPENDENT OPERATIONS

looks like a crayon...

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tells temperatures like a precision instrument!

Sixty-three different compositions enable you to determine and control working temperatures from 113° to 2000° F. TEMPILSTIK° marks on workpiece "say when" by melting at stated temperatures—plus or minus 1%.

ALSO AVAILABLE IN LIQUID AND PELLET FORM ...WRITE ACCESSORIES DIV. FOR SAMPLE TEMPIL° PELLETS...STATE TEMPERATURES OF INTEREST—PLEASE!

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Available in These Temperatures (°F)

113
125
138
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163
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238
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313
325
338
350
363
375
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NWSA Birmingham meeting sets zone attendance mark

The largest number of distributors and manufacturers ever to attend a National Welding Supply Association zone meeting—185—were present at the Southeastern meeting in Birmingham, Ala., on Dec. 6 and 7. Vice-President W. P. McLendon, Keenan Welding Supplies Co., Albany, Ga., presided over the three business sessions.

Applications for membership were received from Albany Welding Machine Works, Albany, Ga.; Florida Gas & Chemical Corp., Hollywood, Fla.; Frank Ford and Associates, Atlanta; Post Welding Supply Co., Birmingham; Texas-Delta Development Corp., Lockhart, Texas; and Wilson Welding Supply Co., Cumberland, Md.

President James N. Alcock, Saginaw Welding Supply Co., Saginaw, Mich., delivered a talk entitled "The 3 C's." Other speakers included: E. M. McKnight, Edmac, Inc., Winston-Salem, N. C.; R. P. McMillan, Southern Oxygen Co., Washington, D.C.; Reid Jones, Jr., Jones Welding Supplies, Roanoke, Va.; Donald Comer, Avondale Mills, Birmingham; Niels C. Miller, Miller Electric Mfg. Co., Appleton, Wis.; A. G. Thompson, Miami Welding Supply, Inc., Miami; Kenneth V. Lutz, All-State Welding Alloys Co., Inc., White Plains, N.Y.; Thomas P. Bowles, Jr., Bowles, Andrews & Towne, Atlanta; James A. Turner, Jr., and William Wolff, National Welders Supply Co., Inc.; William A. Rice, Virginia Welding Supply Co., Charleston, W. Va.; and William J. Bailey, Industrial Relations, Southern Mines District, Republic Steel Corp.

On Tuesday afternoon members visited Westinghouse Electric Corp.'s new electrode plant at Montevallo, Ala.

* * *

Carbon dioxide shields another Mig process

Carbon dioxide as a shielding gas for "Aircomatic" welding of mild steel has proved effective in certain applications, according to Air Reduction Sales Co., Inc., New York City. It has also provided cost savings.

Airco is one of a number of firms that recently introduced carbon dioxide as a shielding gas for their respective Mig (metal inert-gas) welding processes. At this writing, there was at least one more welding-equipment manufacturer ready to unveil a Mig process that uses carbon dioxide as a shield.

Welding Helmets

700-3-C
Fiberglas . . . with No. 1130 Plastic Glass Holder

890-4-C

Two of **AO**'s Many Proved-in-Service Welding Helmets

One-piece fibre construction, lightproof. Protects against arcs of nearby welders. Helmet can be raised or lowered, permitting rapid inspection of work without lifting helmet.

FEATURES: No. 1096 Lift-front Glass Holder of lightweight Dowmetal; No. 4 Free-floating Adjustable Headgear; Type C Outside Adjustable Friction Joint; No. 1182 Fibre Chin Rest.

Shell and shield are compression-molded from thermo-setting Fiberglas reinforced polyester resin. Exceptionally strong, moisture and heat-resistant, they are somewhat lighter in weight than vulcanized fiber helmets or shields. Fiberglas Helmets and Hand Shields are easily sterilized.

No. 3 Free-floating Headgear is of moisture-resistant, nonwarping plastic.

Designed on the free-floating principle, helmet is suspended at all times on connecting arms, thus permitting a flexible, adjustable headband for best head fit, greatest comfort. Headband adjustment is of the positive ratchet type, controlled by a knob. Mechanism is contained within a tube, insulated from the head to avoid hair pulling.

AO Welding Helmets are also available with aluminized asbestos and lightweight aluminized duck.

†T.M. Reg. by American Optical Company

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SAFETY PRODUCTS DIVISION

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for all types and makes of welding equipment

Everything you need from *one* source, with *one* responsibility. The fast, economical way to order. Catalog gives complete specifications, factory numbers, scaled drawings, etc. Write for your free copy today.

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Some Distributorships still open.
Write for information.

BECKER BROTHERS CARBON CO.
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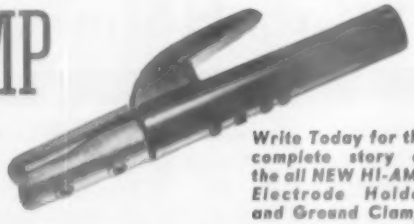
If You'll Just Check the EXCLUSIVE Advantages of the

NEW HI-AMP

ELECTRODE HOLDER—
you won't use any other type!

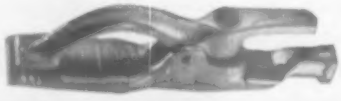


Write Today for the complete story of the all NEW HI-AMP Electrode Holder and Ground Clamp.

- Spring completely enclosed and insulated. Cannot be knocked or shorted out.
- Spring Adjustment Screw for ease of replacement and adjustment to rod size.
- Handle cannot absorb moisture—withstands higher temperatures.
- Spring cannot be knocked out.
- Spring adjustment screw for easy replacement or adjusting.
- Sturdily built for excessive abuse.
- Designed especially for all-round welder's needs.

and that goes for Ground Clamps, too!

- Tip Insulators reversible for longer service life.
- Low Trigger for ease of Rod relief—cuts down operator fatigue.
- Slender rod gripping tongs to get in tight places.



Sold only through Welding Supply Distributors throughout the U.S. and Canada

WAGNER MANUFACTURING CO.
250 W. 1st SOUTH ST. JACKSON, MISSOURI

Weld with Wagner

Canadian Welding Society may initiate awards program

The Awards Committee of the Canadian Welding Society, with the support of society chapters and sustaining member companies, has announced it intends to initiate the first Canadian technical paper competition on welding subjects during the 1955 winter season.

The program has been developed to promote the growth of the welding and fabrication industries in Canada, and to publicize and reward individual and company progress in the fields of welding design, manufacture and maintenance.

The competition is open to everyone engaged in the welding or associated industries in Canada. Classifications of competitions are: procedure of manufacture, including planning and control; design of product, including any or all uses of welding; maintenance of plant, construction or mechanical equipment by the use of welding; and "My Most Interesting Job," a classification to incorporate any phase of welding experience as a student, operator, foreman or superintendent.

Prize-winning papers will be reprinted in leading Canadian technical publications. Complete details may be obtained by writing to: Awards Committee, Canadian Welding Society, Room 423, 73 Adelaide St. West, Toronto.

* * *

Norton Co. building new plant in Alabama

NORTON Co., Worcester, Mass., will add to its electric furnace capacity by building a new plant in Huntsville, Ala. This expansion of Norton's electric furnace facilities, located since 1910 in Chippewa, Ont., will be situated on a 100-acre site in an area known as Hobbs Island, along the north bank of the Tennessee River.

Completion of the plant is expected by the end of 1955. Total cost of land, buildings and equipment is estimated to be $1,250,000.

* * *

Aluminum rolling mill to be built by Kaiser

A NEW multimillion dollar aluminum sheet and foil rolling mill will be built by Kaiser Aluminum & Chemical Corp., Oakland, Calif., on a 2,500-acre Ohio River frontage near Ravenswood, W. Va. It will be the tenth major facility in the company's so-called "ore-to-product" operations. Actual construction was scheduled to start around Jan. 1.

Miller Selenium Rectifier Type D.C. Arc Welders

. . . performance, dependability, ease of maintenance unmatched by any other! *Pulsating* direct current produces sounder, denser welds; minimizes magnetic arc blow and "arc-outs." SR Welders have wider ranges than any other D.C. welder; polarity reverses at the flick of a switch. Miller's patented UNITRAN *combines* transformer and flux diverter. Easily remote controlled or paralleled in combination with other SRs. Models with rated outputs (60% duty cycle at 40 volts) of 200, 300, 400 and 600 amperes.

Miller Heavy-Duty Industrial A.C. Arc Welders

These transformer-type welders achieve high-quality welds at maximum production speeds, feature low maintenance and long life. Ample open circuit voltage stabilizes arc, minimizes "arc-out" time, permits use of all A.C. or A.C.-D.C. electrodes. Continuous current control. Models 102, 103, 104, 105 and 106 rated at 200, 300, 400, 500 and 600 amperes respectively (60% duty cycle at 40 volts). Power factor correction at slight additional cost. Models 105-SA, 107-SA, 108-SA and 109-SA are specifically designed for submerged arc welding, have selective open circuit voltages for automatic welding. Rated secondary amperes (1 hour) are 500, 750, 1000 and 1500 respectively. All SA models are power factor corrected.

20% PLUS FACTOR

Engineer-earned designator for the basically better design, high-quality components, established efficiency and longer life of Miller welders. Complete FREE literature upon request. Get the facts TODAY!

Miller Rectifier Type Sigma Welder

Model SIGMA-5 maintains stable welding conditions regardless of arc variations. Operator can set wire feeding speed on SIGMA head and arc voltage on SIGMA welder. After arc is struck, Model SIGMA-5 automatically regulates filler wire speed and current to maintain constant arc length. Power for SIGMA head and control circuit furnished from within welder. May be paralleled and/or remote controlled. 500 ampere rated output on 100% duty cycle at 30 volts.

miller

ELECTRIC MANUFACTURING COMPANY Inc. • Appleton, Wisconsin

FOR QUALITY WELDMENTS
use
Drawalloy
CORPORATION
QUALITY CONTROLLED STAINLESS STEEL WELDING WIRE

- ▶ available in Spools, Coils and Lengths
- ▶ for Automatic and Semi-Automatic gas and inert arc welding

Welding wire by Drawalloy is made to an exacting high standard . . . a high standard established by long-experienced welding men who know welding wire and how it must work. Set-ups for automatic and semi-automatic welding take more time than regular welding. That's why you want to be sure of satisfaction *before* you start. This *reliable* wire is weld-tested to give the best results every time. Write today for complete information and prices.

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AN AIR REDUCTION PRODUCT

FOR WELDING AND CUTTING...

IN THE RED DRUM

HIGHEST QUALITY

DUST-FREE

NATIONAL CARBIDE

Write for the name and address of the NATIONAL CARBIDE supplier nearest you.

National Carbide Company
GENERAL OFFICES: 60 EAST 42ND STREET, NEW YORK 17, N. Y.
A DIVISION OF AIR REDUCTION COMPANY, INCORPORATED

Full-scale production begins at Shieldalloy

COMPLETION of processing facilities at its Newfield, N. J., plant for full-scale production of special alloys, processed minerals and ferro alloy powders has been announced by Shieldalloy Corp., New York City. This major step in the firm's expansion program means an additional source of supply of specialized materials for welding-rod manufacture and the steel, ceramic and chemical industries.

* * *

Non-destructive test firm celebrates 30th anniversary

St. John X-Ray Laboratory, Califon, N. J., which specializes in X-ray work and other non-destructive tests, will mark its 30th anniversary this year.

* * *

ASTE meets next month

The 23rd annual meeting of the American Society of Tool Engineers will be held March 14-18 in Los Angeles.

* * *

Distributor appointments

Ebert Electronics Corp., Queens Village, N.Y.: Driegner Sales Co., Camden, N.J.

International Rectifier Corp., El Segundo, Calif.: Atlas Radio Corp., Ltd., Toronto, Canada.

Kaiser Aluminum & Chemical Sales, Inc., Oakland, Calif.: Fullerton Metals Co., Miami.

KSM Products, Inc., Merchantville, N.J.: Mobile Welding Supply Co., Inc., Mobile, Ala.

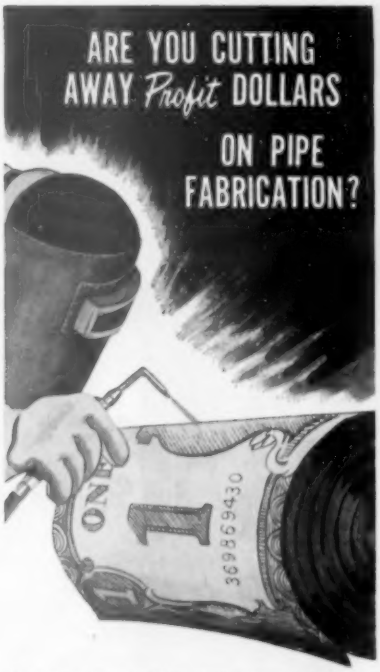
* * *

Pipe for ice rinks

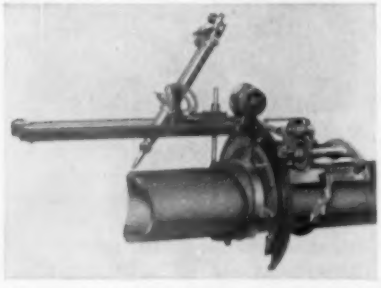
—*The National Supply Co.*

STEEL pipe is installed in an ice rink. This is 1-in. pipe on 4-in. centers, typical of many rinks. The preferred modern practice calls for welding the lengths of pipe together, rather than attaching them by threads and couplings. Steel piping installed 20 or more years ago is still giving satisfactory service.

ARE YOU CUTTING AWAY *Profit* DOLLARS ON PIPE FABRICATION?



If tedious hand-cutting and fitting is chewing up the profits in your pipe fabrication jobs, put a stop to it right now! Your time can be accurately estimated and more profit dollars assured by letting the H & M Shape-Cutter whip out your most difficult contour cutting problems in a matter of minutes. With the H & M here's all you do: Quickly attach the right pattern to your H & M Cutter and Beveler; lift the split horseshoe-shaped gear over the pipe; snap the spring-tension chain



fastener which locks the H & M securely in place; light the torch, adjust the flame and give the crank a few turns — THAT'S ALL, the job is done and you have a perfect, accurate cut, less reject welds assured. For more detailed information —

WRITE FOR THE FREE FOLDER "MORE PROFIT DOLLARS IN PIPE FABRICATION"

H&M PIPE BEVELING MACHINE CO.

Trade Mark Reg. U.S. Pat. Off.

311 E. 3rd. St. • Ph. 3-0241 • Tulsa, Ok.

How about 1955?

A number of predictions for 1955 concerning basic industries were voiced by various spokesmen during January.

The editors of WELDING ENGINEER herewith bring you some of these comments, leading off with the general outlook as seen by the federal government.

High level of production seen for this year

A general high level of production for 1955 is indicated in surveys of basic and leading industries in the United States by the 25 industry divisions of the Business and Defense Services Administration, Department of Commerce.

The 25 Divisions represent the business point of view in government. Each division covers one basic production industry or a group of closely allied industries, totaling more than 400.

Here are some BDSA estimates:

Aluminum shipments for civilian use will set another new record in 1955 for the second year in a row.

New construction activity in 1955 is expected to reach an all time high of $39,500,000,000.

Rebounding vigorously from midsummer, the steel market should hold well into the second quarter. With an estimated production of 88,000,000 ingot tons, 1954 was the best full peacetime year in history.

Nickel production may reach 415 million lb

"Based on available information, it is estimated that free world nickel production in 1955 should approximate 415,000,000 lbs. It is expected, after satisfying defense requirements and deliveries to government stockpiles under present schedules, more nickel will be available to free world industry for civilian applications in 1955 than was the case in 1954."

This was the prediction of Dr. John F. Thompson, chairman of the board, The International Nickel Co. of Canada, Ltd.

Foresees favorable year for copper and brass

The year 1955 should be a favorable year for the copper and brass mill industry, according to T. E. Veltfort, manager of the Copper & Brass Research Association, New York City. With the steady growth of our population and standard of living, the production and consumption of these metals can be expected to increase.

Amco Fluxes . . . .

FIT YOUR JOB

Assure Welding & Brazing Success

. . . EVERY TIME

You are always sure of complete oxide removal and deep penetration when you use the proper Amco flux. Why? Because Amco chemical research and development make Amco fluxes right for the particular job. Whether you're working with ordinary metals, stainless steel, aluminum, cast iron or steel . . . there's an Amco flux to assure perfect bonding.

• Consult us on all your fluxing problems •

Distributor inquiries invited

American Solder & Flux Company

Flux Manufacturers Since 1910

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I don't know anything about welding... but my best boy friend does and he uses...

CMD
CHIPPING
HAMMERS

He even told me why: "CMD hammers are ruggedly built to stand up under hard use day in day out!"

P.S. Some good distributorships are open too! Write us today.

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CHICAGO MANUFACTURING & DISTRIBUTING CO.

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Chicago 9, Illinois

AISC predicts 1955 business will equal last year's

Producers of fabricated structural steel expect their 1955 business to equal 1954, if not exceed it, according to Earle V. Grover, president of the American Institute of Steel Construction, national trade association for the steel construction industry.

In a year-end statement, Mr. Grover said that preliminary reports of the Institute reveal that though the boom no longer exists, 1954 shipments of fabricated structural steel will be the highest since the 1929 peak.

Shipments for 1954 will amount to 3,200,000 tons as compared with 3,117,711 tons in 1953, an increase of nearly 3%. Bookings of new business during the year approximated 2,500,000 tons, against 2,786,590 tons in 1953, a decrease of a little more than 10%. The backlog of unfilled orders during the first 10 months of 1954 dropped from 1,740,000 to 1,300,000 tons.

The high level of construction is expected to hold through next year. Projects proposed throughout the country indicate an over-all construction program amounting to $39.5 billion during 1955 as compared with $37 billion in 1954.

Aluminum outlook for 1955 is good

"The market outlook for 1955 is good, and long range potentials are also most encouraging.

"The rate of aluminum shipments for civilian use in 1954 was even higher than in boom-year 1953. The 1954 production of primary aluminum by the industry in the United States should amount to approximately 1,460,000 tons, which is more than 16% above the record-breaking tonnage of 1953."

These were some of the remarks included in the year-end statement for 1954 made by I. W. Wilson, president of Aluminum Co. of America, Pittsburgh.

Steel capacity increased nearly 1,500,000 tons

The steel industry of the United States started 1955 with an annual steelmaking capacity of 125,828,310 net tons of ingots and steel for castings, according to American Iron and Steel Institute, on the basis of reports from the steel-producing companies.

The new total is the highest ever achieved. It is 1,497,900 tons more than the capacity a year ago, which totaled 124,330,410 net tons.

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...and Save Up to 50%!

With INDEPENDENT'S newly-designed generators, you can make your own high-purity oxygen and nitrogen from the free air . . . and in the same generator.

You reduce costs up to 50% by eliminating handling costs . . . vaporizing costs . . . evaporation losses . . . residual losses . . . and transportation costs.

INDEPENDENT Generators are available in any capacity, any purity and any pressure. Put your oxygen-nitrogen problem up to us . . . our engineering department will gladly submit recommendations . . . no obligation, of course!

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E. F. Hannum has been appointed district sales manager in charge of Ontario operations for all "Manganal" welding products by Stulz-Sickles Co., Newark. His headquarters will be in Cleveland. He has been with the company since 1947.

* * *

C. R. Strehler has been named sales representative of the P&H Welding Equipment Division, Harnischfeger Corp., Milwaukee. He will cover the state of Michigan. Mr. Strehler had been associated with Weldit, Inc., Detroit, during the past 10 years. He will have complete charge of all sales of "P&H" Welders, electrodes and positioners in his area.

* * *

KSM Products Inc., recently announced the following personnel changes: *Donald C. Rolling*, district engineer for the Stud Welding Division, has been transferred from the Milwaukee territory to the Detroit area. *Claude Batuk*, also a district engineer, has been transferred from the Detroit area to the Chicago territory. *F. "Red" Kern* has been assigned the West Coast District. He administered sales for KSM in the Midwest before his transfer.

* * *

M. R. Minnick has been appointed to the newly created position of vice president-sales of The American Welding & Mfg. Co., Warren, Ohio. He had been general manager of sales since 1950. One of the oldest Amweld employees in the point of service, Minnick joined American Welding in 1923 at 18.

* * *

Alex J. Vogl has been named vice-president of sales for The Wilton Tool Mfg. Co., Inc., Chicago. He is succeeded as sales manager by *William J. Ferrick*, who had been assistant sales manager.

Get that extra margin of High Quality and Safety

Specify COYNE *Quick Charging*

ACETYLENE CYLINDERS

- COYNE Cylinders prove their quality in service—they'll give you every service benefit with full economy.
- COYNE Cylinders are made to exacting high standards and are quality controlled throughout each step in their manufacture.
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- COYNE monolithic filler is lighter and faster filling.
- COYNE Cylinders are available in capacities from 10 cubic feet to 320 cubic feet. Write for catalog.

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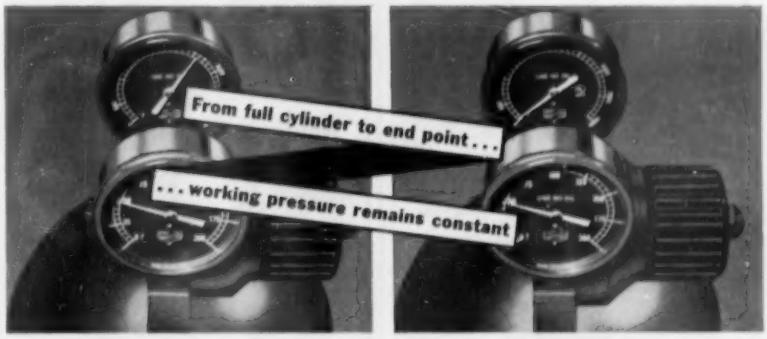
New K-G Single Stage Regulators Out-perform All Others!



- First major development in regulators in 20 years
- Great sensitivity—equal the performance of many 2-stage regulators
- Take apart, re-assemble in 3 minutes—without special tools!
- Slash down-time, maintenance costs . . . increase service life

Entirely new, simplified design! Bodies and bonnets anodized aluminum alloy forgings . . . stronger, lighter, more corrosion-resistant. New sintered stainless steel filter practically eliminates seat failure. Adjusting mechanism rides on ball bearings for smooth, accurate control—is *fully enclosed* for complete protection against damage or loss. New single stage models—1200 Series—for practically all compressed gases. New two stage models—1100 Series—for the *ultimate* in performance! *The K-G Equipment Co., Inc., Dept. A, 1744 Lehigh St., Allentown, Pa.*

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All inquiries given immediate attention and shipments made on short notice. Technical service men are available to assist you in proper joint design. Silvaloy brazing alloys also available in wire, strip, and powder from stocks in six branch warehouses.

1200 FLUX

Use when silver brazing Brass, Bronze, Copper, Nickel-Silver, Steel, Stainless Steel, Monel, Nickel, Inconel and other Nickel alloys. Furnished in ½ lb., 1 lb., 5 lb., 30 lb., and 65 lb. containers.

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PLANTS: DETROIT, ST. LOUIS, MILWAUKEE, MINNEAPOLIS, INDIANAPOLIS
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SOLDERING AND WELDING
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- Make your own test—also send for our pocket-size catalog which contains information and descriptions of our money-saving METAL BOND Products.

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WELDING CLAMPS
• Designed for Welding •
No Threads To Damage

1. Case hardened threads are always protected from weld spatter and never exposed to damage in open or closed position.
2. The clamp body is cut from solid plate, thereby insuring extreme rigidity and giving great resistance to bending or twisting.
3. Heat treated chrome molybdenum alloy handle offers great resistance to bending.

23 stock sizes

CHICAGO BOILER COMPANY
1968 CLYBOURN AVENUE
CHICAGO 14, ILLINOIS

J. F. McRoberts was recently named vice-president and general manager of Progressive Welder Sales Co., Detroit. He joined Progressive in 1953 as assistant to the president. In addition, the stockholders named *John Johansen, Josephine Johnson, John F. Langs*, and *R. F. O'Heron* to the board of directors. Realigning executive responsibilities, the board named Mr. Langs vice-president, Josephine Johnson, secretary, Mr. Johansen treasurer and assistant secretary and *Robert Barley*, general sales manager. Appointed to the newly formed operations committee were Mr. McRoberts, *Ralph S. Pehrson and Ray W. Heiden.*

McRoberts

* * *

J. Douglas Darby has been appointed assistant executive vice president, commercial, of the United States Steel Corp. Succeeding Mr. Darby as vice president and general manager of sales will be *Marcus J. Aurelius*, now vice-president of sales of the United States Steel Columbia-Geneva Division.

* * *

Fred A. Kaufman has been appointed vice president in charge of sales and manufacturing for The McKay Co., Pittsburgh. He had been general sales manager of all McKay products. He first became associated with the firm in 1943. At one time he was sales manager of the Electrode Division of the company.

* * *

James B. Morey has been appointed in charge of the Cincinnati Technical Field Section of the Development and Research Division, The International Nickel Company, Inc., and *William S. Mounce* has joined the division's staff in New York City as a member of the Constructional Alloy Steel Section.

* * *

Harry C. Platt has been elected executive vice-president of the Engineered Castings Division of American Brake Shoe Co. Formerly vice-president in charge of production, Mr. Platt joined the company as a metallurgist in 1942.

ARCAIR torch cuts assembly time 20% in fabricating steel tanks

A NEW TIME and money saving procedure for tank fabrication has been developed in the Seattle, Washington, shops of the Olympic Welding Co., based on the use of the Arcair torch.

In this procedure steel plates are set up for welding, square-butted against one another. A light sealing pass is made on the *inside* of the seam, enough to hold the plates in correct alignment, and the outside seam is left *untouched*. The welder then makes one pass with the Arcair torch, to gouge out the outside seam, which leaves an even, clean groove ready for welding, which was then filled with two passes to give a 100% weld.

The shop foreman at Olympic reports that this new fabrication method has been saving up to 20% in assembly time, by eliminating beveling of plates before fit-up and preparing both sides of the groove simultaneously. Transverse sections and tensile tests showed penetration superior to conventional beveling and welding techniques.

Other methods of gouging, including special gouging electrodes, had previously been tried on this job but with little success, because of uneven grooves produced and prohibitive costs of special gouging electrodes. Chipping or grinding also proved impractical on this application. Olympic also uses their Arcair torches to repair defects. The speed and economy of the Arcair torch led to the development of this new fabrication procedure which has been enthusiastically received wherever it has been used.

In fact Olympic Welding is one of a great variety of industries throughout the world, that have found that use of the Arcair torch solves their metal removing problems faster and cheaper, besides giving a better finished job. Ask your welding supply dealer for a free demonstration in your plant.

Write TODAY for free bulletin showing facts and figures of time and money-saving Arcair applications using the Arcair torch.

ARCAIR COMPANY
427 South
Mt. Pleasant Ave.
Lancaster, Ohio

John A. McDermott has been appointed general sales manager of Crobalt, Inc., Ann Arbor, Mich. He will direct national sales activities on "Crobalite" hardfacing alloys and Crobalt cast-alloy cutting tools. He has been with the company as a sales engineer for the past six years.

* * *

Metal & Thermit Corp., New York City, recently announced several changes in its sales organization. *John B. Tinnon*, vice-president and chief sales executive, has retired but will remain with the organization as a consultant. He is a former director and an honorary member of the American Welding Society. *Donald K. Morgan* has been promoted to general sales manager. *O. L. Howland* has been promoted to assistant to the general sales manager with headquarters in East Chicago, Ind. *Merritt L. Smith*, manager of advertising and sales promotion, has assumed the additional duties of eastern assistant to the general sales manager. *Robert T. Brown*, former district manager in Pittsburgh, has been promoted to manager of sales of the welding division, with headquarters in New York City. *Kenneth H. Zeigler*, sales engineer in the Pittsburgh area since 1951, has been promoted to district manager at Pittsburgh.

* * *

Joseph F. Quaas has been appointed director of manufacturing and production for Eutectic Welding Alloys Corp., Flushing, N. Y. He had been manager of the Electrode Production Division. Before joining Eutectic, Mr. Quaas spent 10 years as a metallurgical observer for one of the nation's large steel companies. He is a graduate of Newark Tech and has served on various AWS and AAAS committees.

* * *

Gustav Schwab, Jr., has been appointed manager of its Marietta, Ohio, pipe fabrication plant by the Machinery Division of Dravo Corp., Pittsburgh.

sellstrom safeguards designed for comfort

New Wide Vision Industrial Spectacles —Hinged Side Shields

These amber tint flesh-colored industrial spectacles have been developed to satisfy the demand voiced by many industrial workers.

1. The spectacles have hinged, perforated side shields which can be tipped inward to permit folding the temples over the side shields. This permits folding like ordinary spectacles.
2. The reinforced, rigid high temples permit the widest possible open side vision while also offering the greatest strength.
3. Temples are very sturdy, nickel-silver, plastic covered. The broad molded section at the front is rounded plastic to assure the greatest possible wearing comfort.
4. Available in three bridge sizes: 22, 24 and 26 m/m.

No. 684. LCG Clear Hardened, 44 m/m lenses. Drop oval.

No. 687. LCG Clear Hardened, 47 m/m lenses. Drop oval.

Give your employees the advantage of the several new features built into these spectacles. The extra comfort, complete protection and extra wide vision will quickly make them a favorite with employees.

Write for Sample Pair on Memo for Examination Purposes.

Yes, on request we will gladly mail you a sample pair for 30 day test purposes in your plant. If after 30 days' use you are not fully satisfied, you can return them for full credit. These are new spectacles. Dealer distribution is under way.

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Eye and Face Safeguards Designed for Utmost Comfort

226 Hicks Road **Palatine, Illinois**

The Inquiring Weldor

BY JOHN WILSON

Question: What advantages have you obtained by standardizing on "Low Amp" EutecTrodes in your maintenance welding?

Richard Marshall, Detroit, Mich. My company makes thermostatic bimetal products and I frequently have to weld very high alloy steels. I find that Low Amp EutecTrodes make welding easier and faster. Here's one example. Before rolling out bimetal strips to the desired dimensions we run them through a furnace. The flanges that hold the muffle to the furnace on one end and the water jacket on the other were continually breaking off. To make the repair we'd have to wait until the furnace cooled, dismantle, repair and then reassemble. Using ChamferTrode and EutecTrode 680 I make the weld in position and the weld lasts as long as the muffle itself.

Question: How has your work in the forging shop been simplified with "Low Amp" EutecTrodes?

Roy L. Brandon, Dearborn, Mich. The cutting edges on chrome moly steel forging dies used to forge connecting rods have to be rebuilt very often. We've had very good results using EutecTrode #680. The welded dies last as long or even longer than new dies. A second troublesome job is the piston rod of a 4,000 pound air hammer which breaks quite often. Normally a new rod would have to be installed, or, the broken rod removed and sent to a special welding shop for repair. We do the job ourselves and have been getting very good results.

Question: Has Eutectic helped you save time in your repair work?

William Gomes, Providence, R. I. It certainly has. Here's an example. We recently had to remove the ⅛ x 15" sleeve inserts at the ends of the 4" thick main shaft of a huge cement mixing and laying machine. On one end, we used a hammer and chisel and it took about 3½ hours of hard work to do the job. On the other end, I used ChamferTrode and removed the insert in about 7 minutes. I used a D.C. machine, straight polarity and about 250 amps. The insert was removed clean as a whistle without damage to the shaft. What a wonderful saving in time, money and hard work.

Question: What has been your experience in working on refrigerated trucks?

Reginald Rorer, West Haven, Conn. I had one job that was real tough. The aluminum racks on the inside of a refrigerated truck had worked loose and had to be repaired. The tracks on the floor of the truck also needed repair. I tried half a dozen different aluminum welding rods but they either wouldn't bond or gave too much spatter. I tried EutecTrode #2101 and got a perfect job. The slightest warping would have ruined the job, but with EutecTrode #2101 there was no warping, no spatter and it made an excellent bond.

EUTECTIC
EUTECTIC LOW TEMPERATURE WELDING ALLOYS clear up welding headaches . . . minimize warping, distortion, stresses and embrittlement. For time and money saving help on welding steels, aluminum, cast iron . . . and all "problem" alloys at temperatures below base metal melting points . . . and for stronger, safer production and maintenance welding just write "Welding Data Bank" for your free copy of "1954 Welding Data File" on your jobs.
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EUTECTIC WELDING ALLOYS CORP.
40-40 172nd St. Flushing, N. Y.

William O. Faxon was recently elected to the newly created post of executive vice-president of Tracerlab, Inc., Boston. He also was named a director.

* * *

John Kozelski has been named general plant manager of Wall Colmonoy Corp.'s new Stainless Processing Division, Morrisville, Pa. Following graduation from Virginia Polytechnic Institute in 1946, Mr. Kozelski joined the Worthington Corp. as a welding engineer. In 1948 he became welding engineer with Wright Aeronautical Corp., where he remained until 1953.

* * *

J. C. Wilson, Jr., president of Acro Welder Mfg. Co., Milwaukee, was elected president of the Resistance Welder Manufacturers' Association at the recent annual meeting in Detroit. *David V. Uihlein*, of Banner Mfg. Co., Milwaukee, was elected vice-president. The technical and research activities of the association will be under the supervision of *J. F. Deffenbaugh*, Federal Machine and Welder Co., Warren, Ohio, for the next two years.

* * *

Fred W. Fisher has been appointed manager of Whiting Corp.'s new sales office in Charlotte, N. C. Assigned to Mr. Fisher's staff is *Harvey K. Waters*, who formerly worked out of Birmingham. *T. L. Iwan* has been assigned to the Ardmore (Philadelphia suburb) district office as a sales engineer. *A. H. B. Stensland* has been assigned to Whiting's district sales office in Pittsburgh.

* * *

W. Harvey Thompson and *H. A. Chandor, Jr.*, have been named vice-presidents of The Riverside Metal Co. Division of H. K. Porter Company, Inc. Mr. Chandor also will be general sales manager.

* * *

Died . . .

Joseph M. Jardine, 67, of Evanston, Ill., died Dec. 4. He operated the Western Welding and Equipment Co. in Chicago until his retirement in 1951.

* * *

Harry E. Howard, 61, personnel manager of Norton Co., Worcester, Mass., died suddenly Dec. 16.

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THE GRAND QUIKCET DUAL GRIP TYPE "AS"

Quick setting double-action clamp grips work more securely. Holds irregular and off-parallel surfaces as well as flat work due to pincer action. Easily tightened in cramped areas.

4 SIZES: 2½" TO 6" OPENING
SPATTER-PROOFED—NACO NO. 6 STEEL
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Famous GRAND "C" Clamps

Alloy Steel (Stronger than forged) Spatter-Proofed Screws, Deep Throat—Replaceable Swivels

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For Cast or Malleable Iron

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Weld Rod Division
THE CHICAGO HARDWARE FOUNDRY CO.
NORTH CHICAGO, ILL.

Metal projects

Projects in Metal for the Home and School Shop. Published by The James F. Lincoln Arc Welding Foundation, Cleveland 17, 1954. Paper, 5⅞ by 8⅝ in., 80 pages. Price 50 cents in the United States, 75 cents elsewhere.

The widely publicized and rapidly expanding "do-it-yourself" movement has had a new field opened to its enthusiasts by the introduction of an arc welding process that requires little skill to use and equipment which is practical for home operation.

This booklet has been reprinted from a larger book, *Farm Arc Welding,* but the projects described are useful for any home regardless of whether it is in the country or in the city. Projects include such things as: tree guard, stair railing, furnace, clothesline post, lawn furniture, wrought-iron work, shop tools, air compressor, pipe bender, vise, ladders, stools, child's slide, swing, boat trailer, grill, and toy tractor. In all, details for making 78 home projects in steel are contained in the book.

The text is profusely illustrated with photographs, charts, diagrams and plans.

* * *

Testing

Testing of Stainless-Steel Weldments. By Helmut Thielsch. Published by the Welding Research Council, New York 18, 1954. Paper, 8¼ by 11¼ in., 26 pages. Price $1.

This publication is No. 18 in the Council's Bulletin Series, which contains reports not published in its regular monthly research supplement. It is a review of published and unpublished information on methods of testing stainless-steel weldments, including mechanical tests, procedure-qualification tests, fluorescent and dye-penetrant, radiographic and ultrasonic inspection, sectioning of welded structures, magnetic inspection, corrosion testing metallographic tests, ferrite, carbide and sigma-phase determination and crack-sensitivity tests.

* * *

I LIKE *trees because they seem more resigned to the way they have to live than other things do.* —*Willa Cather*

cut weld cleaning time by 85%

Throw away your cold chisel and whisk off weld spatter with a dry rag! Protect-O-Metal spatter-proofing compounds make weld cleaning a breeze. Improve your welds at the same time — P-O-M compounds quiet the arc, improve fusion and electrode operation, prevent oxidation and annealing scale, cause no porosity. No smoke, odors, or fumes.

P-O-M No. 2. Non-inflammable, non-toxic, water-soluble paste. Inorganic. Thin before applying and start welding at once. $3.25 per gallon, f.o.b. Dayton.

P-O-M No. 8. Rust- and corrosion-resistant resin base compound. Comes ready to use. Safe for all metals. Good paint primer; permits outdoor storage of sub-assemblies. $3.30 per gallon, f.o.b. Dayton.

MONEY-BACK TRIAL OFFER

Order a trial gallon of each today for testing in your shop. We'll cancel the bill if you're not satisfied.

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Oxygen-Nitrogen from Air

Air SEPARATOR for producing high purity oxygen and nitrogen.

SUPAIRCO

PLANTS AND APPARATUS

- Simple to install
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- Minimum maintenance

We have installations all over the world. Let us know your requirements. We will be glad to furnish detailed specifications and prices.

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Also manufacturers of plants for producing liquid oxygen—liquid nitrogen—liquid air also
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HARD-FACING ALLOYS

Easy to apply
by arc or torch. Flow on extra-readily in a uniform, slag-free layer.

Give Superior Resistance
to abrasion, corrosion, oxidation and impact—with high hardness—even at red heat.

Three Proven Grades
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We mean the seats in oxy-acetylene cutting torches. That's a touchy spot with welders. The point is this: you simply *can't* burn out the seat in Smith's Lifelong, Midline, and Airline cutting assemblies. A built-in patented feature called FLO-TROL eliminates the *cause* of burned-out seats.

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30 YEARS AGO

(Taken from *The Welding Engineer* of February, 1925)

Report of the mid-winter meeting of the Gas Products Association, held in Chicago, is included in this issue.

—30 YEARS AGO—

How one railroad company uses welding for reconditioning fireboxes, engine frames and other car parts is told in this issue by H. D. Adell.

—30 YEARS AGO—

O. A. Benson was elected president of the National Oxygen Co. early this month. He succeeds H. G. Austin, who has retired because of ill health.

—30 YEARS AGO—

The K-H Electric Welding & Sales Co. recently changed its name to Grimes-Hughes Co. The Fort Wayne, Ind., firm will remain at the same office and shop headquarters.

—30 YEARS AGO—

Arc welding in the steel industry is the topic of an article in this issue by W. L. Warner.

—30 YEARS AGO—

The Welding Equipment & Supply Co., Kankakee, Ill., has recently made arrangements to handle the "Rego" line of welding and cutting equipment.

—30 YEARS AGO—

An article entitled "Welding Pipe Bends in Any Form" in this issue tells how repairing of city gas lines proves to be a large item in the use of acetylene welding.

—30 YEARS AGO—

Eighty persons were present at an organizational meeting of a Detroit section of the American Welding Society early this month.

—30 YEARS AGO—

The Roller-Smith Co., New York City, recently announced the appointment of W. H. Pugh as its representative in the northeastern part of Pennsylvania.

—30 YEARS AGO—

The Diehl Welding & Machine Co., Inc., Atlantic City, N. J., has been incorporated to continue the business formerly conducted by J. B. Diehl, who became president of the new firm.

—30 YEARS AGO—

An editorial in this issue, entitled "Mastering Welding" stresses the need for constant study in this ever-expanding field. . . . "Constant study is the really vital factor in the development of welding engineers."

insist on famous "Jorgensen" AND "Pony"

CLAMPS

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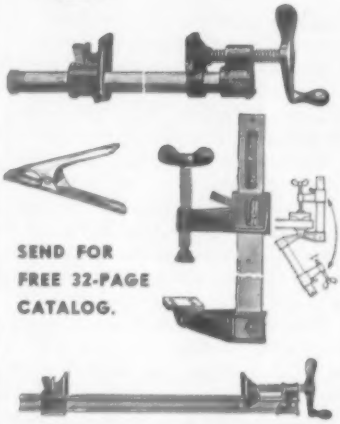

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"The Clamp Folks"
426 No. Ashland Ave. • Chicago 22, Ill.

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"Complete line of "KOP-R-ARC" coated rods for welding copper and all copper alloys."

No. 28H FLUXINE for gas, hydrogen, or heliarc welding of stainless steel and inconel.

No. 44 FLUXINE —for copper brazing —cutting tool metals, carboloy, vanadium alloys, etc.

No. 43 FLUXINE Non-glaring — for low-melting silver solders on stainless steel, iron, inconel, etc. No injurious fumes.

No. 45 FLUXINE — for soldering brass, copper, steel, etc. with low-melting silver solders.

Write on company letterhead for chart and generous sample stating which FLUXINE desired.

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(Est. 1875)
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for the 13th time

1955 **Welding Engineer** MID-JUNE

FACT FILE issue

Now in 7 Big Sections

ARC
GAS
RESISTANCE
GRINDING
METALS
SAFETY
SHOP EQUIPMENT

For easier everyday use, this year's FACT FILE issue will be separated into seven big sections. Each of these sections will include information-packed data sheets, for on the job problems, plus the product classification listings pertaining to the specific process or field. All Arc Welding equipment, accessories and supplies in the Arc Welding section, all the Gas Welding equipment, accessories and supplies in the Gas section, etc., to put complete information at the users fingertips.

And . . The Trade Name Index . . Manufacturer's Names and Addresses

The FACT FILE issue is a new name for a tested and proven work horse. Like last year's issue (then known as the Welding Guide and Product Directory), it will be sent to every one of WELDING ENGINEER'S 20,000 subscribers.

The FACT FILE issue will work all the year for the reader by placing at his fingertips a combination of an accurate and complete Buyer's Guide of product listings and Reference Data section of short-cut tables and other units of useful technical and engineering data. As it works throughout the year for the reader, so it works for the advertiser.

Your advertisement becomes part of the work day of thousands of welding equipment users as they seek out the reference and purchasing data to help them in their jobs. What better reason for putting the FACT FILE issue on your schedule.

1. Sent to ALL WELDING ENGINEER subscribers—over 20,000 of them.
2. A useful selling life of one year.
3. The only buyer's guide with audited circulation. You know the titles of those who receive it.
4. The ONLY welding publication of its kind with technical and engineering data AND a complete buyer's guide.
5. The oldest and most complete buyer's guide in the welding industry.
6. Seven great sections of welding know-how and purchasing source information.
7. The buyer's guide sent exclusively to those with welding buying influence.
8. A long-lived sales-helper; in daily contact with more paid welding management subscribers than any other welding publication in the world.

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Welding Engineer

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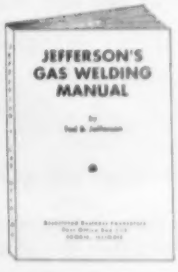
JEFFERSON'S GAS WELDING MANUAL

by Ted B. Jefferson



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WELDING—ITS QUESTIONS AND ANSWERS, was $1.50 now $.75c. Cloth cover, 5 x 8½ in., 176 pages.
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12 E. Grand Ave., Chicago 11, Ill.

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Harnischfeger Corporation

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Established producer of welding products for maintenance and repair wants district sales manager to cover southern Illinois, Missouri, Arkansas, Oklahoma, Texas supervising distribution, contacting trade. Some selling and welding experience desirable, not essential. Salary plus commission.

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WANTED. Electrode Salesman. Must have thorough knowledge of Los Angeles area. Salary and commission. Send complete resume to SK 1554, Welding Engineer, 12 E. Grand Ave., Chicago 11, Ill.

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1/8	P & H 308 Mo(316)	1700 lb.
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3/16	G.E. 307, 19-9 Mn	1500 lb.
5/32	Page-Allegheny 330	1500 lb.
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5/16 G.E. 307, 19-9 Mn ..... 5000 lb. at 20c/lb. for quantity purchase.
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G-E, 6WD33C, 300 amp., 40v, 440/220v, 60cy 3 ph stationary set $285—portable sets available.

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free literature . . . . . USE CARD ON OPPOSITE PAGE

1. R-W ELECTRODES—WW Alloys, Inc. Almost 700 resistance-welding electrodes are listed for practically any welding job in a new large catalog that includes illustrations, specifications and prices. Also lists water-cooled holders, seam-welding wheels, alloy rod and bar stock.

2. LOW-HYDROGEN ELECTRODE—General Electric Co. 4-page brochure (GED-2483) describes "Strikeasy LH-1" a low-hydrogen electrode with iron powder in the coating.

3. STUD-WELDING—Nelson Stud Welding Div. Handy wall chart furnishes condensed information on how end welded studs are used in construction field.

4. GRINDING—The Carborundum Co. Entitled "V40 for Tool Room Grinding," new brochure describes complete line of tool room wheels.

5. HARDNESS TESTER—Andrew King. 4-page illustrated folder depicts King portable Brinell hardness tester.

6. MIG SPOT WELDING — Linde Air Products Co. 4-page illustrated pamphlet describes new Mig (metal inert-gas) spot-welding process and equipment.

7. HARDFACING ALLOY—Coast Metals, Inc. 4-page folder lists chemical and physical properties of "No. 18" hardfacing alloy.

8. WELDMENTS—H. F. Butler, Inc. 4-page, 2-color illustrated brochure presents several examples of how industry is better served by using weldments.

9. WELDING TITANIUM—Mallory Sharon Titanium Corp. Welding titanium is subject of reprint of article by this firm's melting research engineer which appeared in *Materials & Methods*.

10. POSITIONERS — Unique Turntable and Equipment Corp. 12-page catalog No. 54 depicts positioners and turntables recommended for manual or automatic welding.

11. BRAZING HARD CARBIDE — The American Platinum Works. Bulletin 542 is 4-page illustrated folder describing "Silvaloy" brazing of hard carbide.

12. PORTABLE X-RAY—Holger Andreasen, Inc. This firm's portable X-ray units for industrial radiography are depicted in new 8-page brochure. Includes specifications.

13. RESISTANCE WELDERS — Banner Mfg. Co. 4-page booklet depicts press-type spot and projection welders that are air operated and in the 3-150 kva range.

14. HARDFACING ALLOYS—Wall Colmonoy Corp. Engineering data sheet (1A) describes special properties of hardfacing alloys "Nos. 6, 5" and "4."

15. WELDING DATA — Suffolk Iron Foundry (1920) Ltd. 20-page Specification List No. 1054C gives full details of applications of all 31 types of this firm's rods and fluxes for oxyacetylene welding.

16. BRAZING—The American Platinum Works 4-page folder describes uses of "Silvaloy" low-temperature, silver brazing alloys.

17. RESISTANCE WELDERS — Sciaky Bros., Inc. Bulletin 342-2 SPI and EPI covers new standard commercial "SPI" and "EPI" series projection and spot welders.

18. OXYACETYLENE CUTTING — Air Reduction Sales Co. 12-page reprint from *Iron and Steel Engineer* discusses increased uses of oxyacetylene in steel plant operations.

19. SAFETY EQUIPMENT—Mine Safety Appliances Co. "Disaster" is title of new 12-page booklet.

20. WELDED PIPE—Fretz-Moon Tube Co. Inc. How the continuous weld process of pipemaking was developed is told briefly in a new 6-page illustrated folder.

21. BRASS WIRE—Titan Metal Mfg. Co. 4-page folder describes in detail the brass wire produced by this firm.

22. RESISTANCE WELDING—The Taylor-Winfield Corp. No. 548 of "Weld-It" tells how automation is a familiar story at this firm.

23. DUCTILE CAST IRON—The International Nickel Co., Inc. 12-page Bulletin DI-1, with illustrations, graphs and charts, describes recently developed family of irons.

24. ELECTRODES—The Reid-Avery Co., Inc. "Raco" arc-welding electrodes are described in 24-page catalog. One page lists oxyacetylene-welding rods.

25. SELENIUM RECTIFIER — International Rectifier Corp. Bulletin H-1 describes high-voltage, cartridge-type selenium rectifiers.

26. LOW-HYDROGEN ELECTRODE — Alloy Rods Co. 2-page Bulletin AR-8 lists specifications of "Atom-Arc" low-hydrogen electrode with iron powder in the coating.

27. DUCTILE CAST IRON—The International Nickel Co. Inc. 8-page Bulletin DI-2 is entitled "Engineering Applications of Ductile Cast Iron."

28. WELD RADIOGRAPHY — General Electric Co. 4-page illustrated brochure depicts and explains "OX-175" portable X-ray unit for weld inspection.

29. PIPE MARKERS—W. H. Brady Co. 6-page Bulletin No. 135-B describes self-sticking, card-mounted "All Temperature Pipe Markers."

30. METAL CLEANING—Manufacturers Processing Co. "Vapor Degreasing Do's and Don'ts" is 24-page manual of advanced operational methods for metal cleaning.

31. WROUGHT IRON—A. M. Byers Co. Bulletin entitled "Wrought Iron for Marine Applications" gives case-history reports.

32. OPERATION RECORDERS — The Bristol Co. Bulletin OP1505 describes and illustrates line of electrical and mechanical operation recorders.

33. STUD-WELDING GUN—Nelson Stud Welding Div. 4-page folder pictures and describes the "NS-9," a newly designed and improved stud welding gun.

34. ELECTRIC DRILL—Milwaukee Electric Tool Corp. 2-page leaflet D-10 illustrates and lists specifications of "palm push" electric drill, available in six models.

35. OVERLAY SPRAY—Wall Colmonoy Corp. 4-page bulletin describes new "Model C Spraywelder" and metal-spraying process used in welded overlay-type hardfacing applications.

36. WELDED CONNECTIONS — Erico Products, Inc. "Portability" is title of 4-page brochure depicting typical "Cadweld" installations.

37. ARC WELDERS—Hobart Brothers Co. Gas-drive arc welders are subject of profusely illustrated pamphlet; cost cutting is emphasized.

38. GRINDING WHEELS — Colonial Abrasive Products Co. 4-page booklet describes "Grindaway" wheels, which are reinforced with abradable safety rings.

39. WELDING DATA—Metal & Thermit Corp. Complete set of new catalogs designed for welding engineers and others cover entire line of firm's electrodes for arc welding as well as rods and wire for gas, submerged arc and inert arc.

40. ELECTRODES—A. O. Smith Corp. Manual on mild-steel, cast-iron, high-tensile and low-hydrogen electrodes includes complete welding information.

41. HOISTS—Coffing Hoist Co. 8-page bulletin includes pictures, drawings, descriptions and specifications of this firm's line of spur-gear hoists.

42. SAFETY EQUIPMENT — General Scientific Equipment Co. 1955 issue of "Everything in Safety" covers personal protective equipment and industrial safety devices.

43. ELECTRODE HOLDER—Duro Engineering Co. 4-page illustrated pamphlet describes "Duro" family of electrode holders, including "Duro-Lite," which weighs but 16 oz.

44. WELDING DATA—All-State Welding Alloys Co., Inc. Pocket-size folder includes "how-to-do-it" data on welding, brazing, soldering and cutting steel with specially developed alloys and fluxes.

45. WEDGE BARS—Stulz-Sickles Co. Actual-size illustrations of "Manganal" wedge bars are featured on 24 by 36 in. wall chart for determining correct bar to use in rebuilding any worn tooth.

46. FUME EXHAUSTERS—The Engwald Corp. 4-page illustrated catalog depicts welding-fume exhausters and blowers.

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USE THIS CARD for Literature, Catalogs, and bulletins shown on facing page, and for those featured in this month's ads as listed on next page

Also information about

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★ For copies of any manufacturers' bulletins described on page at left, circle the number of the items on card at right. Fill in your name, title, company and address. This has to be done only once on each post card. You need no postage.

★ For additional information on New Products described in this issue, circle the numbers of the items that interest you. The New Products section begins on page 50.

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Chicago 11, Ill.

literature offered in advertisements in this issue:

2. Bulletin on contact electrode—General Electric Co.
38. Literature on safety and construction of grinding wheels—Colonial Abrasive Products Co.
101. Pocket catalog of fluxes—Metal Bond Mfg. Co.
102. Folder on fluxes for cast iron, bronze and aluminum—Chicago Hardware Foundry Co.
103. Clamp catalog, 32 pages—Adjustable Clamp Co.
104. More profit dollars in pipe fabrication—H & M Pipe Beveling Machine Co.
105. Data on pipe layout—Contour Marker Corp. of Calif.
106. Data on stainless wire for gas and welding—Drawalloy Corp.
107. Story of "Hi-Amp" electrode holders and ground clamps—Wagner Mfg. Co.
108. Carbon welder brush catalog; specifications, factory numbers, etc.—Becker Bros. Carbon Co.
109. "Phoson" folder for brazing pressure pipe—United Wire & Supply Corp.
110. Maintenance data, "Ampco-Trode" for increasing part life—Ampco Metal, Inc.
111. Acetylene generator facts — Sight Feed Generator Co.
112. Folder on tungsten electrode—North American Philips Co., Inc.
113. Data on nickel electrodes for cast iron welding—Alloy Rods Co.
114. Data on Neoprene and rubber-covered cable—Carol Cable Div.
115. Technical data on contact electrodes—Reid Avery Co.
116. Folder on flux recovery systems—Invincible Vacuum Cleaner Mrg. Co.
117. A complete guide to successful silver brazing—The American Platinum Works.
118. Bulletin on Mig welding — General Electric Co.
119. Data on welding electrodes and wires—Page Steel & Wire Div., American Chain & Cable Co., Inc.
120. Manual on hardfacing—Victor Equipment Co.
121. How to get better welds—Hobart Brothers Co.
122. Electrode holder catalog—Erico Products, Inc.
123. Bulletin 43 on improved welding helmet—Fibre-Metal Products Co.
124. Facts on a complete line of a-c and d-c welders—A. O. Smith Corp.
125. Research results on Tig welding with a-c and d-c—Sylvania Electric Products.
126. Data and prices on complete line of electrode holders, ground clamps and cable connectors—Tweco Products Co.
127. Data on new 6013 electrode—National Cylinder Gas Co.
128. Hardfacing guide book—Stoody Co.
129. Resistance welding catalog—P. R. Mallory & Co., Inc.
130. Booklet on "Allowable Working Pressures"—Tube Turns.
131. Complete application instructions for use of "No. 11" nickel-silver brazing rod—All State Welding Alloys Co., Inc.
132. Catalog on stainless steel electrodes—Metal & Thermit Corp.
133. Data on complete line of d-c a-c and a-c/d-c welders—Harnischfeger Corp.
134. Folder on "Carboflex" depressed center wheels—The Carborundum Co.
135. Catalog on steel, brass, bronze and cast-iron gas welding rods—Metal & Thermit Corp.
136. Newly revised nickel and nickel alloy welding bulletin T-2—The International Nickel Co., Inc.
137. Booklet on "MX" abrasive products—The Carborundum Co.
138. Bulletin on control of seat burn-out in oxyacetylene cutting torches—Smith Welding Equipment Corp.
139. Catalog on carbon and low-alloy steel wires for submerged-arc welding—Metal & Thermit Corp.
140. Folder on "Port-A-Belt" grinding attachments—The Carborundum Co.
141. Facts and figures on time and cost savings from arc cutting—Arcair Co.
142. Catalog on mild and low alloy arc welding electrodes—Metal & Thermit Corp.
143. Catalog on aluminum and phosphor bronze electrodes—Metal & Thermit Corp.
144. Booklet on iron-powder electrodes—Westinghouse Electric Corp.
145. Folder No. 540710 describes oxy-fuel torch for intense-heat applications—The Harris Calorific Co.
146. Bulletin 1343 shows how hand welding can be simplified. The Lincoln Electric Co.
147. Literature on a-c and d-c welders. Miller Electric Mfg. Co., Inc.
148. Pressure regulators are included in 24-page catalog. The K-G Equipment Co., Inc.
149. Catalog and price information. Coyne Cylinder Co.

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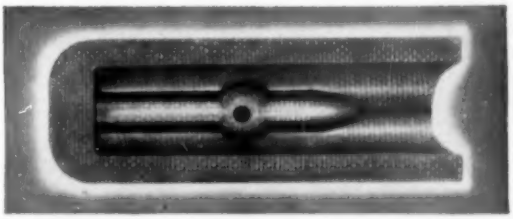
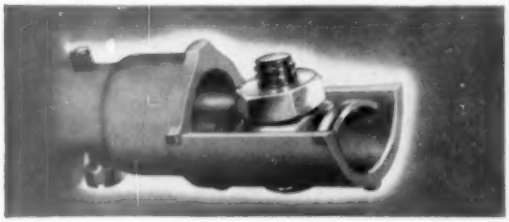
Why People Buy
TWECOTONG
Electrode Holders

1. INTERNALLY-KEYED INSULATION

Patented "Super-Mel" laminated glass cloth insulation (30 layers), exclusive to TWECOTONG, is internally-keyed to the holder casting. Won't shift, won't break, won't burn. All top and bottom jaw tip insulation interchanges.



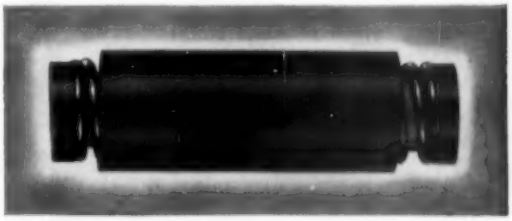


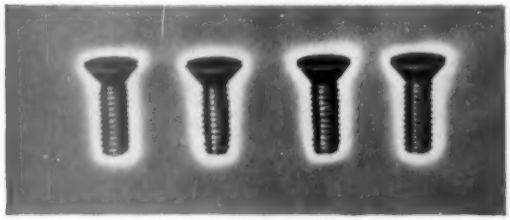
2. CLAMP and SOLDER CONNECTION

Every regular model TWECOTONG is equipped with a simple Clamp and Solder Cable Connection — an exclusive Tweco feature. You can use **either or both** for sound, trouble-free connections. Cable is easily attached in the field with pliers or a Crescent wrench.

3. SINGLE UNIT SPRING ASSEMBLY

Only one part to buy. Heavy fibre washers pressed into the ends of the spring insulate it from the holder. Heat and oil resistant Neoprene sleeve keeps spatter, dirt and corrosion out of spring. No meshing spring cups to bind, or clog, or break.





4. JUST 4 SIMPLE SCREWDRIVER SCREWS

All you need is a screwdriver and a Crescent wrench to maintain TWECOTONG. All insulation is installed with only 4 identical slotted screws. No need to hunt for Allen wrenches or other special tools when you use TWECOTONG Holders.

TWECOTONG Holders are made in six Rod-Rated models, each designed to handle several different rod sizes. Uniform design permits interchange of parts in many models — simplifies your stocking problem. Call your local supplier for a demonstration ••• put one of these cost-cutting holders on trial in your plant. You'll be glad you did!

$5.50
10 TO 25% LESS IN QUANTITY

350 AMPERE
MODEL A-14 TWECOTONG

SEE YOUR LOCAL WELDING SUPPLY DISTRIBUTOR

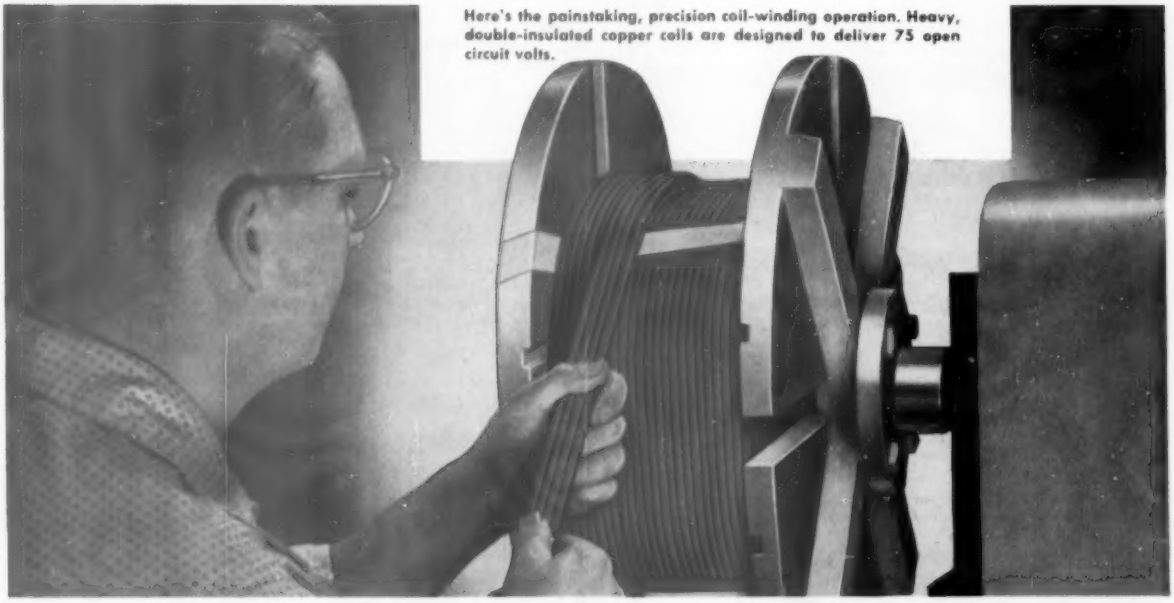
WRITE FOR TWECOLOG
Data and prices on the complete TWECO line of electrode holders, ground clamps and cable connections.

Tweco
MANUFACTURERS OF ELECTRODE HOLDERS • GROUND CLAMPS • CABLE CONNECTIONS FOR ELECTRIC WELDING
PRODUCTS COMPANY
BOSTON AT MOSLEY • WICHITA, KANSAS, U.S.A.

TWECO PRODUCTS

Full 75 open circuit volts

yours with ALL A. O. Smith a-c production welders



Here's the painstaking, precision coil-winding operation. Heavy, double-insulated copper coils are designed to deliver 75 open circuit volts.

• Low temperature rise (just 55° C) for longer machine life offered by A. O. Smith Heavy Duty a-c welder. Precision coil winding of extra-heavy copper combines with high-velocity ventilation and sound machine design to limit temperature rise . . . to make your welder last almost twice as long as other welders.

Precision-wound coils of extra-heavy copper combine with good design to give you all this—

75 open circuit volts for wider working range! Welding is much faster, far easier, even in vertical and horizontal positions. No more pop-outs with low hydrogen electrodes.

75 open circuit volts for more work done! Yes, more production on every shift. Arc action is faster and smoother at all current settings.

75 open circuit volts for better welding quality! Your men can realize all their skill. Far fewer rejects to hamper productivity.

75 open circuit volts for welder satisfaction! Operators are happier, more efficient . . . because they can work fast, work better.

Everything for Welding **is yours from A. O. Smith — a-c and d-c welding machines . . . complete selection of electrodes . . . accessories.**

Get full details on the a-c Heavy Duty and other A. O. Smith welding equipment. Ask the representative who calls on you, or write direct.

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